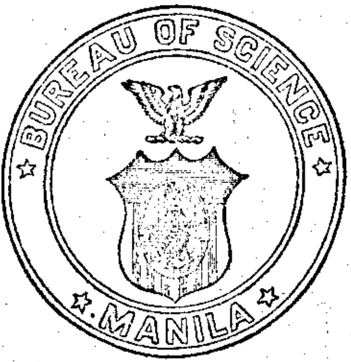
VOL. 19, NO. 3 SEPTEMBER, 1921

THE PHILIPPINE JOURNAL OF SCIENCE



MANILA
BUREAU OF PRINTING
1921

181052

THE PHILIPPINE JOURNAL OF SCIENCE

Published by the Bureau of Science of the Government of the Philippine Islands

ELMER D. MERRILL, M.S., *Editor*

R. C. MCGREGOR, A.B., *Associate Editor*

ALBERT H. WELLS, A.B.; GRANVILLE A. PERKINS, PH.D.; A. P. WEST, PH.D.
T. DAR JUAN, A.B., PHAR.D.; F. AGCAOILI, A.B.; A. S. ARGÜELLES, B.S.
ALBERT E. W. KING
Chemistry

WARREN D. SMITH, PH.D.; ROY E. DICKERSON, PH.D.
Geology

H. W. WADE, M.D.; OTTO SCHÖBL, M.D.
F. G. HAUGHWOUT; STANTON YOUNGBERG, D.V.M.
Experimental Medicine

LIBORIO GOMEZ, M.D., PH.D.; F. CALDERON, B.A., L.M.
VICENTE DE JESUS, M.D.
Clinical Medicine

W. H. BROWN, PH.D.; C. F. BAKER, M.A.; ATHERTON LEE, M.S.
O. A. REINKING, B.S.A., M.S.; L. M. GUERRERO, PHAR.D.
Botany

ALBERT C. HERRE, PH.D.; C. F. BAKER, M.A.; S. F. LIGHT, M.A.
C. S. BANKS, M.A.; L. D. WHARTON, M.A.; W. SCHULTZE
Zoölogy

H. O. BEYER, M.A.; OTTO JOHNS SCHEERER, M.A.
Anthropology

ANNA B. BANYEA, *Copy Editor*

Manuscript intended for publication and books for review should be sent to the editor. One hundred separates of papers published in the Journal are furnished to authors without charge. Additional copies may be had at authors' expense.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

The Journal is issued twelve times a year. The subscription price is 5 dollars, United States currency, per year. Single numbers, 50 cents each.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed on the third page of this cover.

THE PHILIPPINE JOURNAL OF SCIENCE

VOL. 19 SEPTEMBER, 1921 NO. 3

FILARIASIS IN CHINA

By J. PRESTON MAXWELL[1]

Of the Peking Union Medical College, Peking, China

TWENTY-FIVE PLATES AND FOUR TEXT FIGURES

Among the causes of chronic invalidism and economic loss in China, filariasis may well be considered worthy of a place. It is true that the effects are not so striking in its influence on the death rate as those of plague among acute affections, or malarial fever and dysentery among endemic diseases; nevertheless in certain regions it plays a large part in diminishing the working capacity of a considerable number of the manual workers and in rendering many of them altogether incapable of work. The ætiology of the disease, considered in its broad aspect, is simple. With the one exception of an ocular filaria described first in China by Stuckey and Houghton(43) and now classified by Leiper(18) among *Thelazia*, there is only one filaria in China to be found in man; this is *Filaria bancrofti*. *Filaria perstans* has been seen once, but not in a Chinese, and there was no doubt that the infection had been acquired on the west coast of Africa, where the patient had previously resided.

Thus the subject of filariasis resolves itself into infection with *Filaria bancrofti*. This infection is carried out in China as elsewhere by the agency of the mosquito. *Culex fatigans* and *C. pipiens* are both common in China, although it is possible that there are other varieties of the Culicidæ that are potential carriers of the disease. According to Dutton(14) one variety of *Anopheles* is also a potential carrier. Post-mortem examinations of its victims are still few in number, and there is much yet to be worked out concerning its morbid pathology.

---

[1] Before coming to Peking, Dr. J. P. Maxwell was engaged in medical mission work in Fukien Province; this paper represents the results of twenty years' study of the subject and includes material that was compiled for a thesis, but which has never been published.

We do not yet know, for example, how long it takes after infection before the embryos appear in the blood stream; nor do we know why hyperfilariasis does not take place in those who are continuously exposed to the bites of infected mosquitoes. We do not know how long the adult worms are capable of putting forth embryos, nor do we know the true cause of filarial periodicity. Occasionally it is possible for the parent worms to die as the result of a catastrophe, which may involve the human host and cause his severe illness or even death; and if this has taken place and the human host has survived, it is possible for the latter to become reinfected and again present the phenomena of the disease.

Yet again it is possible for the human host to harbor the parasite and present no symptoms of disease at all, the only evidence being the presence of the embryos in the circulating blood at the proper time.

The distribution of the disease throughout China is somewhat peculiar. Roughly speaking, the infection does not spread north of the Yangtse Valley, though individual cases of the disease may be met with farther north. These individuals, however, have been infected in the southern regions and not in the northern.

Following the line of the Yangtse River west, the disease is found sporadically along both banks and also in Kweichow and southern Szechwan, getting less and less frequent as one ascends the river.

Coming back to the coast from the mouth of the Yangtse down to the Tonquin border there is a belt some 15 to 25 miles (25 to 40 kilometers) broad, and the major portion of the disease is found in this coast belt. Most of the islands off the coast are also infected, but not heavily. When one passes inland beyond this belt, the infection is practically lost, although occasionally a small patch of infection may be found on the higher reaches of a river; for it tends to spread upward along the banks of all the rivers between the mouth of the Yangtse and the Tonquin border, but not to any considerable distance. Kiangsi is entirely free, and Fukien away from the coast belt is uninfected, and when imported inland, except in the larger river vicinities, the disease does not, according to my experience, tend to spread.

The case incidence, of course, varies with the region and, speaking broadly, increases toward the south and decreases toward the north. Taking a large hospital about the middle of the coast belt, I found a percentage of 2.4 of filarial cases, who came to the hospital for some disease connected with this infection (Changpu, Fukien); but this does not represent the incidence of filarial infection in this region. My figures give a percentage of 24.8 of the general population infected with the parasite, and the work of my successor at that hospital, Dr. J. H. Montgomery, shows a slightly higher figure.

Besides these figures, 3.39 per cent of the general population showed no embryos in the blood, but presented signs of old filarial disease, while 16.1 per cent of another series were found, on microscopical examination, to be infected but presented no signs and had no history that could be attributed to the presence of filaria.

With regard to the age incidence, taking a series of 67 cases affected with filarial disease, we have the following findings:

TABLE 1.—*Showing age at which disease commenced in sixty-eight cases.*

Ages in years.	Cases.
1 to 10	1
10 to 20	6
20 to 30	22
30 to 40	25
40 to 50	10
50 to 60	3
Above 60	1

TABLE 2.—*Showing duration of disease before patient's first visit to hospital.*

Years.	Cases.
1	7
1 to 5	28
6 to 10	17
11 to 15	9
15 to 20	6

According to the nature of their disease, a series of two hundred sixty hospital patients can be classified as follows:

TABLE 3.—*Two hundred sixty patients, classified according to disease.*

	Cases.
Elephantiasis of scrotum	48
Lymph scrotum	44
Elephantiasis of right leg	35
Elephantiasis of left leg	43
Elephantiasis of both legs	13
Filarial abscess	33
Filarial gangrene of scrotum	8
Lymphatic fistula	6
Chyluria	4
Other filarial diseases	26

All classes and varieties of individuals may become subjects of filariasis. The oldest patient in this series was 64 years of age; the youngest patient was 13, but patients may be infected at a still younger age.

There is no doubt that for some reason the female sex in this region is not so subject to filariasis as is the male sex. This may be partially due to dress, the women keeping their legs and ankles much more covered than do the men.

Of the two hundred sixty cases listed in Table 3, only five were women.

I am unable to give the statistics of infection among women in the general population, as they are so superstitious that there has been great difficulty in obtaining specimens of their blood; but granting that the mosquito-infection theory is correct, there is no absolute reason why anybody and everybody should not become infected.

There is no doubt that the field laborer is more subject to this disease, and to its severer forms, than the literary man and the shopkeeper. Probably the amount of leg that is normally bare contributes to this fact, and the rough, dirty work greatly assists such diseases as elephantiasis of the scrotum and leg.

It has been surmised that the fisherman is especially subject to the disease, but there is not sufficient evidence to support this assertion. Very often the immediate inhabitants of the seaboard are badly off and do not get sufficient to eat, and the exposure to salt-laden wind and blowing sand would assist the development of elephantoid changes.

Let us now turn to the parasite itself and the diseases of which it is the cause. The embryonic form of *Filaria bancrofti* was first discovered in 1863 by Demarquay(13) in a case of chylous dropsy of the tunica vaginalis. In 1866 Wücherer(46) found the same form in a case of chyluria. In 1870 Lewis(19) confirmed this in a case in India. In 1872 the same observer discovered that the blood of man was the normal habitat of the parasite. In 1874 Sonsino,(42) without knowledge of Lewis's discovery, made the same observation in Egypt.

The parental form was first discovered by Bancroft, sr.,(2) in Australia.

The discovery of the mosquito as the intermediate host was made by Manson in 1877;(24) and Bancroft, jr.,(3) in 1899, demonstrated that the complete metamorphosis takes about sixteen days.

Finally Low,(20) in 1900, showed that the filaria, after attaining its proper development, makes its way into the proboscis of the mosquito, apparently with a view of leaving the mosquito when it bites, and this migration generally takes place in pairs.

The parent filariæ[2] have been found many times. They are nematode worms, both sexes being found in the human body "often inextricably coiled about one another." They are some 3 to 4 inches (7.6 to 10.2 centimeters) in length, hairlike, and transparent. They have been found in many situations: in lymphatic trunks, in lymphatic varices, in varicose lymph glands, in the tissues removed in operating on lymph scrotum, in the tissues removed in operating on elephantiasis of the scrotum, and in filarial abscesses. The female worm is the larger of the two. In length, it is from 3 to 4 inches (7.6 to 10.2 centimeters); in breadth, about 1/90 of an inch (0.2 millimeter); the greater part of the body is occupied by the two uterine tubes, containing ova in all stages of development. The head is club-shaped and simple, and the tail is tapered and rounded off, with the anus opening just in front of its termination. The vagina opens near the mouth. The cuticle is smooth and devoid of markings.

The male worm is very slender and has a marked tendency to curl. The extreme end of the tail is sharply incurved. The cloaca gives exit to two unequal, slender spicules. Caudal papillæ are present. These parent filariæ have considerable mobility and can be kept alive in salt solution for some hours. Having described the parental forms of the worm, let us look at the characters of their progeny.

The ova are not normally found in the blood or lymphatic system; in fact, the appearance of these probably means that parturition has not gone on normally and has an important bearing on the question of lymphatic obstruction. I have met with them once in a case of lymph scrotum, in a microscopic preparation got by tapping the lymphatic system of that part, and in this case repeated examination failed to find the embryo in the blood. On the other hand, the embryo could be readily made out coiled up inside the ovum. The size of these ova is stated by Manson (25) to be about 1/500 by 1/750 of an inch (0.051 by 0.034 millimeter). The embryo coiled up in the ovum gradually stretches its chorional envelope, which probably forms the sheath of the mature filarial embryo.

In describing the embryos of *Filaria bancrofti*, as commonly met with in the blood, I largely follow Manson's description, having verified the same in all points. When examined in a fresh specimen, the worm is easily made out as a transparent, colorless, snakelike organism, which wriggles about very actively among the blood corpuscles, but which does not rapidly pass out of the field of vision. It has a long, slender body, inclosed in a delicate, structureless sheath, in which it easily moves backward and forward. This body is blunt at the one end and pointed at the other. It is about 1/80 of an inch (0.317 millimeter) in length and 1/3000 of an inch (0.0085 millimeter) in breadth. It is most easily found with a 1-inch objective, but for the details a higher power must be employed.

---

[2] For a full description of the parent filariæ and their embryos see Tropical Diseases. Cassell, London (1917) 681–702.

Carefully examined under a higher power and with the assistance of a staining reagent, a musculocutaneous layer is made out, in which delicate transverse striation can be discerned. An indefinite viscus can also be made out in the center portion of the worm, rather toward its posterior end. A shining V-shaped spot is clearly to be seen about the junction of the head fifth with the remaining four-fifths of the body. This spot is well shown on staining with dilute hæmatoxylin, but is readily seen in unstained specimens. By staining, however, a second spot is also brought out a short distance from the tail, much like the first in form. The exact meaning of these spots is not quite clear, but it is suggested that they are connected with development. In the interior of the musculocutaneous cylinder is a mass of cells whose nuclei are brought out well by staining. There is a break in this central column of nuclei at a spot just posterior to the anterior V-spot, but the significance of this break is not yet understood.

The head is covered by a delicate 6-lipped prepuce, and a short fang is occasionally to be made out, protruding from the head, in specimens where the worm has almost ceased movement.

One of the most notable things about these filariæ is the feature that goes by the name of filarial periodicity. In the case of the embryos of *Filaria bancrofti* it is the rarest thing to find one of these in the peripheral blood during the day. About 5 or 6 o'clock in the afternoon a few begin to appear, and the number gradually increases until the maximum is reached, about midnight. The number then gradually diminishes until about 6 or 7 o'clock in the morning, when they disappear from the blood altogether till the following evening. If, however, the filarial subject be made to sleep during the day and rise at night, it is possible to reverse these conditions and cause the filariæ to appear during the day instead of at night. In the

Philippines it is known that this periodicity is usually lacking, and by the acetic acid concentration method, even where the regular periodicity prevails, it is possible to show that microfilariæ are never entirely absent from the peripheral blood.

What is the cause of this periodicity? To answer that it is a provision to enable them to be reached by their intermediate host is only to throw the question a step further back. What then is the cause that leads them to forsake the periphery during the day? Possibly it has to do with the accumulation in the body of some chemical substance which, while producing sleep, tends to attract the filariæ to the periphery. In this connection an article by Lynch[8] is of importance as confirming the views of Smith and Rivas that the mechanics of the capillary circulation play a large part in the production of filarial periodicity. He gives details of some experiments with drugs which alter the vessel tone. A vasodilator such as nitroglycerine was followed by a decrease of the embryos in the peripheral blood, while vasoconstrictors such as epinephrin or pituitrin were followed by an increase of these embryos, and a collapsed lung in a dog accumulated microfilariæ immitis in enormous numbers.

Their absence from the liver and spleen during the day, as proved by the results obtained from aspirating these organs, is remarkable. These results have been completely confirmed by the post-mortem examination reported in 1899, by Manson, (26) of the case of a man harboring this parasite who committed suicide during the day by swallowing prussic acid. In this case the liver and spleen were both practically free from embryos, and both of these organs are markedly concerned with metabolic processes.

Where do the embryos retire to during the day? In the case of suicide above quoted they were found to be distributed as follows:

TABLE 4.—*Distribution of embryos in body of man dying in the daytime.*

Lung	Many.
Large vessels near heart	Many.
Vessels of heart wall	Many.
Brachial venæ comites	Moderate number.
Liver	Almost absent.
Spleen	Almost absent.
Brain	A few.
Scrotum	None.

---

[8] Lynch, K. M., Filarial periodicity, Journ. Am. Med. Assoc. 73 (1919) 760.

How they, in their sheaths, manage to maintain their position in the larger vessels against the blood stream is as yet unexplained.

So far we have dealt with the parasite in its human host; now we must deal with its progress through its intermediate host.

By artificial means it is quite possible to make the filarial embryo cast its sheath. One of the best ways is to lay the preparation in an ice box overnight. When the slides warm up next day, wherever the blood has become laky, the filariæ endeavor to break through their sheaths, and in a short time they succeed in doing so and move very freely about the slide.

After the blood has passed into the mosquito's stomach, the same proceeding takes place. A few hours after feeding, this can be easily observed, and in another few hours the mosquito's stomach is found to contain only the empty sheaths. Where have the filariæ gone? As soon as they lose their sheaths, they become able not only to move about freely, but also to pierce the stomach wall.

They are found to have passed into the muscles of the mosquito's thorax. There they undergo a metamorphosis lasting some sixteen to twenty days, a proceeding which has for its result the formation of a mouth, an alimentary canal, a peculiar, trilobed tail, and finally a parasite much grown in size and activity. The metamorphosis being completed, they pass forward for the most part to the cephalic region, a few only passing backward into the tissues of the abdomen.

From the head they pass often in pairs into the proboscis, and are conveyed thence into the human host when the mosquito bites. They lie in the proboscis between the under surface of the hypopharynx and the upper surface of the labium, extended in the loose connective tissue of the latter.

As far as my researches go, in at least 95 per cent of the cases especially examined for eliciting the source of infection there was either a near relative, or a neighbor, or some one of the same village to be found as a possible source. But there were also cases like that shown in Table 5.

In this case the mother had lived with the father for at least twenty years after he started elephantoid fever, but she had never suffered from any form of filarial disease. Her blood was quite free from the parasite. The sons, who were infected and noninfected, had always lived together and slept two in one bed and three in another. The two infected ones had acquired the disease about thirteen and twelve years previously; at least their attacks of fever began about that time. Although they had continued to live cooped up in this way, no other member of the family had been infected.

TABLE 5.—*Showing irregular incidence of infection of one family by filariæ.*

	Age.	Condition.
Father		Dead; had slight elephantiasis of leg.
Mother	60	Uninfected.
Girl	18	Bought. No sign of disease.
Son	37	Uninfected.
Do.	34	Do.
Do.	31	Infected.
Do.	29	Do.
Do.	26	Uninfected.

Three years ago one of the infected individuals went to live in a separate house with his aunt and cousin. Although mosquitoes infected with filariæ have been found by me in this house, and there is nothing to prevent the members of the household being freely bitten, yet this aunt, aged 50, and cousin, aged 13, remain uninfected. The other infected individual married two years ago, and his blood literally swarms with filariæ, yet his wife at the present time shows no sign of disease.

How are these facts to be explained? It may be declared that in order to bring about a successful infection the mosquito bite must be in a region richly supplied with lymphatics and that probably this has not been the case in these persons. Both of the infected brothers are, otherwise, strong and healthy, and they were in good health when the attacks began. This tends to negative any theory that rests on the premise of lowered vitality as the cause that makes successful infection take place.

The probability that a single individual can be infected more than once, and that many mature worms may be found in the same subject, seems on the other hand to indicate that, in some instances at least, infection is not a work of great difficulty.

It is very probable that many people are bitten by the filaria-infected mosquito, with the result that the worm passes into their tissues, but it does not follow that embryos appear in the blood of such patients. For the appearance of these, it is necessary that the female worm should be present and should have been fertilized by the male.

Let us suppose that the male fails to find the female. Possibly they die and are absorbed without giving trouble.

At the same time, it is possible that a single worm might, by setting up an inflammatory process, lead to the blockage of a main lymphatic trunk, in which event embryos would be absent, and yet the case might present some of the characters of filarial disease. It is quite possible also that such a worm in its death might give rise to filarial abscess.

In this connection one may perhaps refer again to the tendency of the worms to pass in pairs into the proboscis of the mosquito; it may be intended by nature thus to provide, by the introduction of a male and a female, for reproduction.

The whole subject is one that needs careful working out, in view of its importance in devising prophylactic measures. For the present no doubt the mosquito net is the reasonable means of prophylaxis, each infected individual being a source of danger to the community.

MICROSCOPICAL DIAGNOSIS

For examination of fresh specimens, it is only necessary to take a large drop of the patient's blood, cover it gently with a cover glass, and examine it under a low power of the microscope, when the filaria is easily distinguished by its movement. If such preparations are ringed with vaseline, it is possible to preserve them for some time: at any rate, the filariæ may be kept alive for at least a week.

For systematic study it is better to keep to a fixed time. In these researches for statistical purposes all the specimens were taken between 9.30 and 10 o'clock in the evening. As my patients used to go to sleep at an early hour, and were up at daylight, this time was late enough.

For this class of work it is better to use specimens prepared in the following way: The blood is taken from the finger or ear, a lancet or triangular needle being the best instrument for the purpose. Several drops of blood should be received on a glass slip and spread out gently with the needle. The slide must then be laid aside on a flat surface and covered, to prevent dust spoiling the specimen. Two specimens at least should be taken from each patient. As soon as convenient, and the sooner the better, these slides, which must be already dry, are fixed by warming them over a spirit flame, and then are immersed in water. This dissolves out the hæmoglobin and leaves a colorless specimen, which is then placed in a watery solution of methylene blue for a few minutes, passed through water, and examined wet without a cover glass under a 1-inch objective. The filariæ are easily distinguished, being stained a distinct blue. The white corpuscles take the dye; the red corpuscles remain unstained.[4] In this work a mechanical stage with parallel movement is quite indispensable. If it is wished to prepare permanent specimens of filariæ, a patient should be selected in whose blood there are many embryos. A very thin preparation of blood should be taken and fixed with alcohol or heat. The hæmoglobin is washed out by water acidulated with a little acetic acid; the specimens are stained with any stain that may be wished and are mounted permanently in balsam. For single stains, hæmatoxylin or methylene blue are very good, while for double staining hæmatoxylin and eosin make a good combination.

I have already stated that the staining should be done as soon as possible. It is possible to leave the slides in a dry place for months and yet get a satisfactory result, but the removal of the hæmoglobin becomes more difficult, and the specimen does not stain well. It need hardly be said that, in taking the blood, due care must be taken. The needle or lancet must be carefully sterilized, and the skin of the part from which the blood is to be drawn should be cleaned first with soap and water and then with spirit. If this is done, there are never any unpleasant effects following.

The acetic acid concentration method of Smith and Rivas[5] is of great use in giving a quantitative estimation of microfilariæ in the blood.

The method is as follows:

> From 0.1 cc. to 1.0 cc. of blood is taken from the finger and collected in 5 cc. of a 2 per cent acetic acid solution for the purpose of laking the blood. The mixture is shaken gently for several minutes and then centrifuged and spreads are made from the sediment.

Lynch[6] used 1 cubic centimeter of blood in 10 cubic centimeters of 2 per cent acetic acid solution, centrifuged, washed and recentrifuged several times, spread the sediment on a slide and counted the whole number in the sediment.

During 1902 Gulland(15) suggested the possibility of the diagnosis of filariasis from a differential count of the leucocytes in the blood of the patient. He pointed out that filariasis is accompanied by a leucocytosis proportional to the number of filariæ found in the peripheral blood. Not only are the leucocytes increased in number, but there is a distinct condition of eosinophilia, which also varies in proportion to the number of filariæ present. Gulland's observations have been confirmed by Coles,(10) whose percentages are given in Table 6.

---

[4] For this method, which works very well, I am indebted to Sir Patrick Manson.

[5] Smith, A. J., and Rivas, D., Notes upon human filariasis, Am. Journ. Trop. Dis. and Preventive Med. 2 (1914) 368.

[6] Lynch, K. M., Filarial periodicity, Journ. Am. Med. Assoc. 73 (1919) 760.

TABLE 6.—*Cole's differential count percentages.*

Leucocytes.	Case I.	Case II.	Normal.
	Per cent.	*Per cent.*	*Per cent.*
Multinuclear	34	43	60-75
Lymphocytes	44	33.5	24-30
Large uninucleated	7	6.5	3-6
Eosinophile	15	17	2, not above 3.

There is also a constant high proportion of lymphocytes, while there is a low percentage of polymorphonuclears.

At first sight it looks as though the data given in Table 6 might be a method helpful to diagnosis, but so far as I can judge the range of usefulness is very small; for, in the first place, it is just in the cases where the embryos are very difficult to find that the eosinophilia is least and therefore inconclusive; and, in the second place, *Ascaris, Oxyuris, Tænia,* and *Ancylostoma* are all prone to produce an eosinophilia.

In the region in which I worked the majority of the people were infected with *Ascaris,* while ancylostomiasis and other worm infections are by no means rare. With this knowledge, given a doubtful patient with a slight degree of eosinophilia, one would hesitate to say, on this ground alone, that he was the subject of filariasis; while, if the parasite be found in the blood, the method is unnecessary for diagnostic purposes.

A very valuable paper on this subject has been written by Whyte of Swatow, China.(44) Calvert(6) argued that eosinophilia is greatest when microfilariæ are absent from the peripheral blood; but Whyte hesitates to accept this view, and I agree with him.

FILARIAL DISEASES

In the first place, it must be again borne in mind that often the filarial worm gives rise to no inconvenience whatever and appears to be absolutely innocuous. It may be harbored for years without the host having any idea of its presence. The diseases dependent on its presence may be classified as follows:

I. Inflammatory mischief, either directly or indirectly connected with the parasite.
  1. Elephantoid fever.
  2. Lymphangitis.
  3. Erysipelatoid inflammation.
  4. Dermatitis and cellulitis.
  5. Abscess.
  6. Orchitis.
  7. Acute arthritis or synovitis.
  8. Gangrene of the scrotum.
  9. Filarial hæmoptysis.

II. Disease due to obstructive interference with the lymphatic system.
  1. Lymphatic varix.
  2. Lymphatic fistula.
  3. Varicose groin glands.
  4. Lymph scrotum.
  5. Chyluria.
  6. Chylous dropsy of the peritoneum.
  7. Chylous dropsy of the tunica vaginalis.
  8. Chylous diarrhœa.
  9. Elephantiasis scroti.
  10. Elephantiasis vulvæ.
  11. Elephantiasis of the legs.
  12. Elephantiasis of the arms.
  13. Elephantiasis of the mammæ.
  14. Elephantiasis of limited skin areas.

INFLAMMATORY MISCHIEF, EITHER DIRECTLY OR INDIRECTLY CONNECTED WITH THE PARASITE

ELEPHANTOID FEVER

Elephantoid fever is somewhat of a misnomer, as the fever is by no means always followed by elephantiasis; but its meaning is now so well known that there is no fear of confusion.

Fig. 1 shows very well the characteristics of a typical case. A filarial subject may be attacked in one of two ways. In the one form, after an hour or two of malaise, he is suddenly taken with a rigor, which may be exceedingly severe, but which is generally of moderate severity. The temperature rapidly rises, and the patient feels very ill, with a hot and burning skin and sometimes marked nausea. This condition persists for from forty-eight to seventy-two hours, and then the temperature falls with moderate rapidity, reaching the normal in from twelve to twenty-four hours. This fall is often accompanied by profuse sweating. In the other form there is no rigor, but there is malaise for some hours before the attack. There is also marked uneasiness or tenderness in some lymphatic region. The temperature rises rapidly, and the patient is as ill as in the preceding case, and the course and the termination of the affection are much the same.

It must be clearly understood that elephantoid fever may take place without any external signs of lymphangitis; on the other hand, very often there are definite signs of inflammation in a lymphatic region, although occasionally these are limited to the one physical condition of tenderness. Although elephantoid fever has been classified as an entity separate from lymphangitis, it is a question whether there is not in every case an affection of the deep or superficial lymphatics.

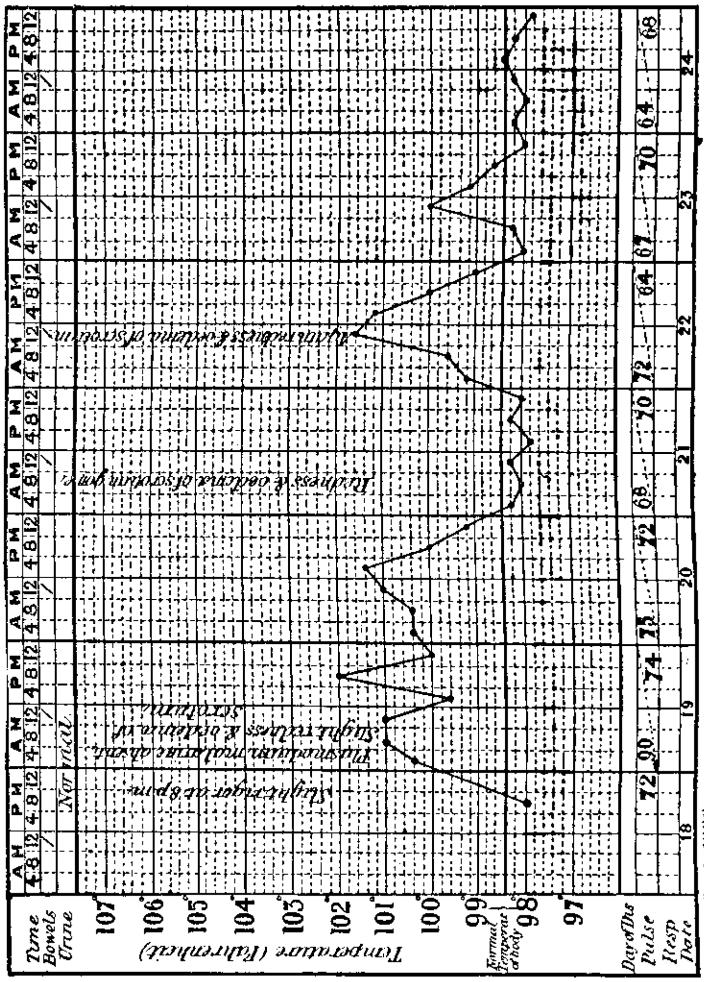


FIG. 1. Chart of elephantoid fever.

During these attacks there is often severe headache, delirium, and anorexia. Predisposing causes to an attack are a severe strain, as seen in the case of the burden bearers of this district; but overfeeding is a still more potent cause. During four years I frequently had, as one of my burden bearers, a man whose blood swarmed with filariæ. Sometimes he used to visit an island where the people were most hospitable and fish was plentiful; as often as he visited this place, this man got an attack, apparently through overfeeding. Cold and wet do not seem to be very potent causes in bringing on an attack.

As to treatment, there is no need to order the patient to bed, for he is feeling too ill to wish to be anywhere else. When an attack is well under way, there is no form of treatment that will stop it; but if the case be seen before the fever has started, it may be partially or wholly aborted by a sharp purgative and a stiff dose of quinine. Three or four "Livingstone rousers" and 15 grains of quinine in acid are a good prescription, and the fever has been cut short by this method in a remarkable way.

If there is a manifest accompanying lymphangitis, this should be suitably treated. Phenacetin sometimes gives relief to the headache and diminishes the fever, but its action in this respect is not at all certain. It may be said, generally, that once the fever is established, expectant treatment is the only course open to the medical man.

There is but little practical difficulty in the diagnosis of elephantoid fever. As a rule, there is some accompanying lymphangitis; and even if there is none, generally the native is quite able to distinguish between it and malarial fever. On one occasion a man walked into the consulting room and told me that he was suffering from both filarial fever and malarial fever. He was quite right, his malarial attack taking place at the time he foretold it, the quartan parasite being easily found, and two attacks of filarial fever occurring during his fortnight in the hospital. This case had no manifest accompanying lymphangitis.

LYMPHANGITIS

In the great majority of forms of filarial disease, lymphangitis is present at one time or another. If the affected lymphatics are on the surface, the characteristic red streak on the skin and the tender cordlike swelling of the lymphatics are very manifest almost at the commencement of the attack. Often, even before the commencement of the fever, the lymphatic glands of the implicated region are a little swollen and tender. If the attack is at all severe, the inflammation will spread to the surrounding parts, the skin of which will become tense and shiny.

Should the inflammation proceed farther, a severe cellulitis may ensue, or lymphorrhagia may take place.

As a rule the inflammation subsides under appropriate treatment, leaving behind, however, a legacy in the shape of some permanent thickening. This thickening is variable in amount, and it is almost impossible to predict in any given case what measure of thickening will be left.

The area of inflammation is sometimes very extensive. In one case the lymphatics of both cords, superficial lymphatics of the scrotum, and the lymphatics of the upper parts of both thighs were affected, and the condition of the patient was by no means enviable. But in other cases the inflammation of the lymphatics is confined to a very narrow area. In the upper arm this is often the case, and the inflammation in one patient was confined to an area less than 2 inches (5 centimeters) in length in the region of the brachial artery.

I have seen filarial fever without manifest lymphangitis; I have never seen filarial lymphangitis without fever of greater or lesser degree.

Diagnosis is easy, as a rule, as the absence of local cause and the presence of filariæ in the blood are readily determined. If there is a manifest possible local cause, it is sometimes difficult at first sight to be sure, but before long the course of the case gives clear indication.

As to treatment, rest, lead and opium lotion, and the treatment previously advised for elephantoid fever quickly clear up the trouble.

If the attack fails to resolve, a careful watch must be kept for the formation of abscess. It has been recommended that the swollen area should be scarified or pricked. Experience leads me to advise strongly against this procedure. It is extremely difficult to keep the parts about the scrotum, especially in natives, aseptic; and it is quite possible to start a most troublesome lymphorrhagia. In a few cases, after the inflammation has subsided, it may be advisable to dissect out the thickened lymphatics, and sometimes in this way it has been possible to secure the parent worm, which by its presence may have given rise to the lymphatic inflammation.

ERYSIPELATOID INFLAMMATION

It becomes necessary to use a name such as erysipelatoid to describe erysipelatoid inflammation, for the term "erysipelas" would convey a false idea. While it is no doubt true that the superficial resemblance between this affection and erysipelas is by no means slight, yet there are very important differences to be noted. Foremost among these is the practically non-contagious nature of this disease. In earlier practice it was feared that Chinese students might carry infection from such cases to operation cases, but it was soon found that this danger was a negligible quantity, as cases may lie alongside newly operated cases without any harm occurring. In spite of this, however, it is not an advisable thing, as it is quite possible for a filarial subject to get ordinary erysipelas, and the distinction is not always easy.

The rash, too, is far more diffused and, as a rule, it has no clearly marked, raised border. Argument from the constitutional symptoms cannot be used, as these vary within wide limits. It is not at all uncommon to see several of these affections of filarial origin present at the same time in one and the same patient, thus preventing any definite deductions from constitutional symptoms. Generally the diagnosis from erysipelas is easy because of these concomitant filarial affections; but occasionally a patient will come into the hospital with erysipelatoid inflammation and cellulitis of one leg, in whom this is practically the first serious symptom of the disease, and in such a case it is almost impossible to make an absolute diagnosis from erysipelas at first sight.

I have not found it possible to follow the Brazilian (5) physicians in dividing erysipelatoid inflammations into several classes. The only division that seems to me to be at all useful is to distinguish two forms:

a. Erysipelatoid inflammation of all degrees of severity from simple erythema to an acute type to be described later, and which generally terminates in the death of the part.
b. Ordinary erysipelas in a filarial subject.

The form in which the joints are simultaneously attacked is dealt with in a separate section.

What is the materies morbi in these cases?

In the case of *b* undoubtedly the poison is *Streptococcus erysipelatis*, and the pathology of these cases is perfectly well known.

In the case of *a*, however, the pathology is not so clear. There is, undoubtedly, lymph stasis in the infected area, and bacteriological examination of these cases is much needed. Such work as has been done is not conclusive. There is evidence to show that it is not merely a case of poison introduced from the outside. If a lymphatic fistula becomes established in an affected region (and very often a leg ulcer may serve the purpose), no attacks of filarial fever or erysipelatoid inflammation will occur as a rule, so long as drainage is kept up. Heal the ulcer or close the fistula, and the attacks recommence. This lends some weight to the view that these filarial inflammatory attacks are due to a poison that is generated in the body itself and not introduced from the outside into tissues that are merely weakened by the presence of the parasite or into an area of lymph stasis.

It is very easy to say that all these attacks are set up by small wounds, scratches, insect bites, and the like, but the evidence on this matter is far from satisfactory. Careful examination has often been made for a point of local infection; but, although sometimes points that might serve can be found, it is difficult to satisfy oneself that such was the actual point of infection.

Treatment consists of rest in bed and elevation of the affected part. In the case of the leg, wrapping it in a continuous cold-water dressing gives great relief in some cases. The bowels should be kept well open, and quinine and iron should be given internally. One of the marked features is the lingering character of some of these cases. An attack may last only a few days; on the other hand, it may drag on for a fortnight or three weeks. Not infrequently second and even third attacks may supervene while the patient is in bed recovering from the first.

DERMATITIS AND CELLULITIS

The section on dermatitis and cellulitis need only be dealt with shortly, as it concerns a more acute form of the inflammation seen in erysipelatoid inflammation or lymphangitis. Clinically it is just like an ordinary cellulitis, only much more amenable to treatment. For this reason it is not necessary to be in a hurry to incise, as many cases will yield to the treatment described in the last section. An additional reason for being cautious is that wounds made under these circumstances heal very slowly. A simple incision in a case of this kind may take seven months to heal. On the other hand, if it is clear that there is imminent danger of extensive sloughing, then free incision should be made at once, as the effects of extensive sloughing are most disastrous. As an illustration may be adduced the case of a man who came under care in the last stage of this trouble. He was greatly emaciated; he had had cellulitis in the lower part of both thighs, with the result that both legs were the subject of bad contracture. The cellulitis had also left him with lymphatic fistulæ on the outer surface of each thigh. Both legs were the subject of elephantiasis, and the condition of the man was miserable beyond description. He was extremely anæmic and died of exhaustion ten days after entering the hospital.

In rare cases the dermatitis becomes ulcerative. Of this only one good instance has been seen by me. It is always the result of infection of the bullæ which are apt to form on the surface of a limb that is already affected by erysipelatoid inflammation or the like. It must be treated like any ordinary ulceration, its pathology being precisely the same.

ABSCESS

Abscess of the scrotum is a disease by no means common in England even when we include tuberculous abscess connected with the epididymis and testicle, and it was a cause for some surprise and not a little incredulity to be confronted, soon after arrival in China, by a patient whose scrotum, swollen to the size of a fœtal head, appeared to be little more than a bag of pus.

The history of this patient was a curious but at the same time a typical one, although at the time it was not known to be such. Fifteen days previously, while at work, he had been seized with a violent rigor, which lasted about ten minutes and then passed into fever, which had been persistent since. He was cognizant of no previous illness, and denied any attacks of lymph fever, stating that he had been a strong man all his life. He was aged 42 years. He refused to come into the hospital, and I was unwilling to operate in his dirty hovel. Eventually part of the scrotum sloughed, and after a long illness, the man recovered. He was, however, subsequently troubled by attacks of elephantoid fever.

In seeking for the cause of this and subsequent cases of a like nature, gonorrhœa could easily be excluded, as not more than 30 per cent of the patients confessed to having had it. None of them had stricture of the urethra, and the orchitis, when present, was slight; in many cases it was absent. Besides the fact that the abscesses were mostly outside the testicle and seminal tract, the further knowledge that Morris[7] did not mention such an affection put it almost out of court.

---

[7] Diseases of the Urinary and Generative System. Cassell, London (1895).

Injury, with the suppuration of consequent hæmatoma, next suggested itself as a possible cause. But in every case in the list injury could be absolutely excluded.

Infection by the bite of some insect could also be excluded. Manson (27) mentions abscess as a manifestation of filarial disease, but it is well to realize that this may be the first and only manifestation. Systematic examination of the blood of the patients who suffered in this way showed every one to be suffering from *Filaria bancrofti;* and, in considering the subject of filarial abscess, every doubtful case (that is to say, every case in which lymph fever could not be found or a definite history obtained of this symptom) has been excluded. Only about one in ten abscesses judged to be filarial in origin has been excluded owing to this test, and none of these were abscesses of the scrotum.

To turn to the general question of filarial abscess, its incidence is naturally limited only by the incidence of infection with the filarial parasite, and it may occur either as an incident in the course of filarial disease or as the first symptom and sign of the same. It may occur in any situation where there is loose connective tissue, rich in lymphatics, and for this reason the majority of abscesses outside the scrotum are in the vicinity of the great vessels, and the abscess does not always form in the situation where the inflammatory focus starts. In two of the cases in which a filarial abscess was opened over the lower end of Hunter's canal, there was good evidence that the inflammatory focus was first situated in Scarpa's triangle. Both the patients themselves and students who saw the cases before me are perfectly clear on this point; this evidence is important as bearing on the question of pathology.

Previous observers, on opening such an abscess, have found the dead body of a parent filarial worm, and they have justly surmised that some at least of these abscesses were the result of the death of the parent worm.

In one of my cases portions of the body of a parent worm were found, but in none of the others could anything of the kind be found, although a most thorough search was carried out. In some, however, the abscess was of some standing, rendering the absence of a dead parent worm insufficient proof. On two occasions broth cultures were inoculated without any result, and in some there are undoubtedly ordinary pyogenic organisms, but these are cases which have been neglected and in which the skin is about to slough.

Dr. J. H. Montgomery has also found a parent worm in a case of this nature that came to him at Choanchiu, Fukien.

Some cases are probably due to causes other than the death of a parent worm. I was fortunate enough to be able to observe the whole process in a patient, who was in the hospital for a trivial affection. Within the space of a few days he had an attack of filarial lymphangitis of the cord on both sides of the scrotum; one side came to suppuration, the other did not. Both, at the outset, presented exactly the same appearance, the inflammatory process on the one side being apparently much the same as on the other.

On two other occasions, by promptly putting the part at rest and applying cold, the inflammatory process has been aborted. As a rule, a sharp local attack leads to the formation of pus.

There is another fact that has to be taken into account in considering the pathology; namely, that some of these abscesses in the scrotum are suppurating hydroceles. In such a case it is difficult to see where the death of a parent worm can come in, as parent worms have never been found inside hydroceles. One is inclined to think that the majority of these are due to a local cause and are probably connected with the blocking of lymphatic vessels; but there is no evidence to offer in support of this view save the fact that in some cases the abscess is the first manifestation of an affection that ends in elephantiasis of the scrotum or of the affected limb. In others it certainly does not end thus, but possibly this is due to the fact that a lesser area of the lymphatic system has been interfered with.

FILARIAL ABSCESS

Passing from the pathology of the disease to its clinical form and diagnostic point, these abscesses may be classified as follows:

Filarial abscess:
- A. Of the scrotum.
    - 1. Suppurating hydrocele.
    - 2. Abscess of the cord.
    - 3. Abscess below the testicle.
- B. Of the limbs.
- C. Intra-abdominal or intrathoracic.

Concerning the cases contained in *A*, the division may seem at first sight to be arbitrary and unnecessary. A further consideration will show that it is not really so. Commencing in the way that is common to all abscesses, they follow different courses and each must be treated in a different way.

Suppurating hydrocele.—A hydrocele of moderate or large size is usually already present. At the commencement of the attack this swells to nearly double its previous size and becomes intensely tender and painful. In a day or so the contents are purulent, and if left to itself the wall and skin over it will slough and the contents will discharge. A long convalescence may ensue, as the opening thus formed may be very large. Tapping is of use only in the early stage, and when the contents have become purulent, incision and drainage should be employed. Care should be taken to have the opening at the most dependent part, and the thick layer of lymph lining the hydrocele sac should be removed. Free bleeding will ensue, and the cavity may have to be packed for twenty-four hours with gauze. Healing is usually rapid, but care should be exercised not to allow the external opening to close too soon. Strict antiseptic precautions should be observed.

Abscess of the cord.—This is the most serious of the forms of abscess affecting the scrotum, by reason of the liability of the inflammatory process to spread up the cord. In several cases I could trace the cord as a thick, hard rope as far up as the internal ring; moreover, it was intensely tender. Whether or not in these cases there is any associated inflammation of the neighboring peritoneum, there is no positive proof; but the fixity and tenderness of that part of the abdominal wall is suggestive, and it is well known that an acute septic infection of the cord may spread inward and set up an acute septic peritonitis. Although the inflammation in these filarial cases may spread up the cord, the actual abscess in all the patients seen was outside the external abdominal ring. Abscess of the cord is also the most serious of the forms of abscess affecting the scrotum as regards treatment. The abscess is apt to have loculi and pockets, which interfere with free drainage and, consequently, with rapid healing.

Abscess below the testicle.—This is the simplest of the filarial abscesses occurring in the scrotum. Drainage is easy, and healing is rapid, a few days sufficing to end the affection, as the abscess does not extend far and is not of large size. From one of these the portions of a parent worm were obtained, and it is possible that all the abscesses in this situation are due to a similar cause.

Filarial abscess of the limbs.—As I have previously stated, abscesses of this kind occur in situations rich in lymphatic tissue, and generally in the immediate neighborhood of the large vessels. It is not an uncommon thing, on opening one of these abscesses, to be able to put a finger on or even around the main vessel of the limb. It is one proof of the mild form of inflammatory process that I have never seen one of these vessels give the slightest trouble from secondary hæmorrhage, due to softening of the vessel wall and subsequent rupture.

Of these abscesses, those in relation to the femoral artery give the most trouble. This is partly on account of their deep connections and the difficulty of thorough drainage. In some of them the lymphatic system seems to be so thoroughly disorganized that they pass directly into the commencement of an attack of elephantiasis of the limb. Consequently prognosis of the ultimate result of treatment must be guarded.

The treatment consists in free drainage; owing to the difficulty of draining the deeper portions, it is well to make free openings under chloroform and insert large rubber tubes. Troublesome contracture of the lower limb may occur during the healing of large abscesses, especially those involving the popliteal space. This can be avoided by splinting the limb and using massage as soon as possible. But among Chinese patients, who are absolutely intolerant of restraint, and over whom we have not the same command as in England, troublesome contracture is by no means unknown.

Intra-abdominal or intrathoracic abscess.—I have had no experience with intrathoracic abscess, but have met with four cases of the intra-abdominal form. In each case the illness coincided with the cessation of attacks of elephantoid fever, and each case was desperately ill when admitted to the hospital. All had commenced in the way hereafter described as typical.

In two cases deep fluctuation was present in the left lumbar region, and under chloroform a postperitoneal abscess was opened that apparently had no connection with any of the large abdominal organs. The urine contained the faintest traces of albumen in one of these cases, but neither formerly nor at the time of operation were there any symptoms pointing to disease of the kidney.

The first patient left the hospital at his own request; he was still desperately ill. The abscess was draining well, however, and he made an excellent recovery after having been ill for two and a half months.

The second was a similar case. He was operated upon in the same place, but made a speedier recovery.

The third came into the hospital looking like a typical appendicitis patient. He also was very ill, having been so for one and a half months. The abscess proved to be extraperitoneal; it extended both into the iliac fossa and downward into the pelvis. Probably it began in the loose tissue about the iliac vessels; the fact that the disease began with a rigor and immediate flexion of the right thigh on the abdomen to an extent that is rarely seen in an uncomplicated attack of appendicitis lends color to this supposition. This case slowly healed up, and the man regained health and strength. His bowels were regular and natural at the time of the attack.

The fourth was a case of perinephric abscess that had been neglected and had tracked into the gluteal region. Free incisions had to be made in both the lumbar and the gluteal regions. This patient was also very ill, but with free drainage and care he, too, did well.

Manson's (28) advice on the subject of these abscesses is sound:

> Deep seated pain in the thorax or abdomen, with inflammatory fever followed by hectic, and a diminution in the number of micro-filiariæ in, or their entire disappearance from the peripheral blood, should, in such circumstances, suggest a diagnosis of filarial abscess, and indicate exploration, and if feasible, active surgical interference.

Finally we must discuss the onset of this malady and its typical temperature. Fig. 2 is a typical temperature chart of the disease. Rising rapidly with a rigor, which may occur while the man is at work in the fields, cutting wood, or even lying in bed, it remains high for from one to three days and then descends by lysis, provided an unopened abscess is not left. On the other hand, if the patient be under favorable conditions and it is possible to abort the attack, the temperature may descend very rapidly (fig. 3).

In neglected cases and cases that do not run a proper course, owing to insufficient drainage or wide inflammatory focus, the temperature may assume a septic type (fig. 4).

In criticism it may be urged that this temperature is the result of *Plasmodium malariæ* complicating the filarial attack. In reply it may be stated first, that in many of the cases the blood was carefully examined for *Plasmodium malariæ* with negative results; and, second, that it is quite possible for the fever, due to the presence of *Filaria bancrofti*, and active malarial attacks to run concurrently, but in such cases both diseases are clinically and microscopically distinct; and moreover the patient, as I have proved in two instances, has been right in his statement that one night he had a filarial attack and the next an ordinary quartan paroxysm. In no case of filarial abscess of the limbs referred to in these lists was there any focus of infection to be discovered on the surface of the limb.

ORCHITIS

A great many diseases in times past were credited to malaria. Some of these seem to have been so considered on totally inadequate grounds. In fact, the presence of malaria in a country has been held to account for almost any obscure disease in that country. While not denying that there may be a form of malarial orchitis, it is quite clear that in the region in which I have been working the majority of cases of orchitis are not malarial but filarial. In fact, I have never seen a case in which

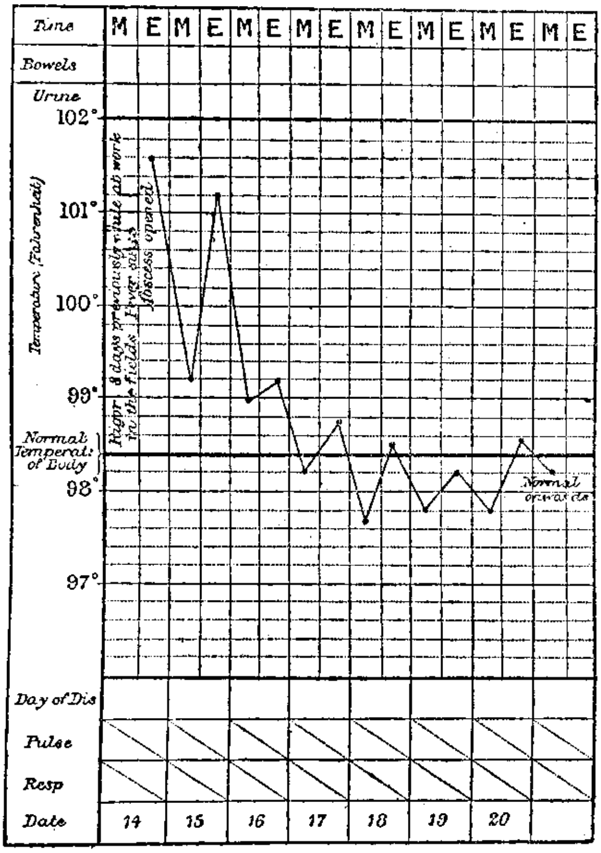


FIG. 2. Typical chart; filarial abscess.

there was any suspicion of its being malarial; and this in spite of the fact that the whole region is scourged with malaria, large spleens being common, and malignant cases by no means rare.

Here is a typical example of a case of filarial orchitis: A

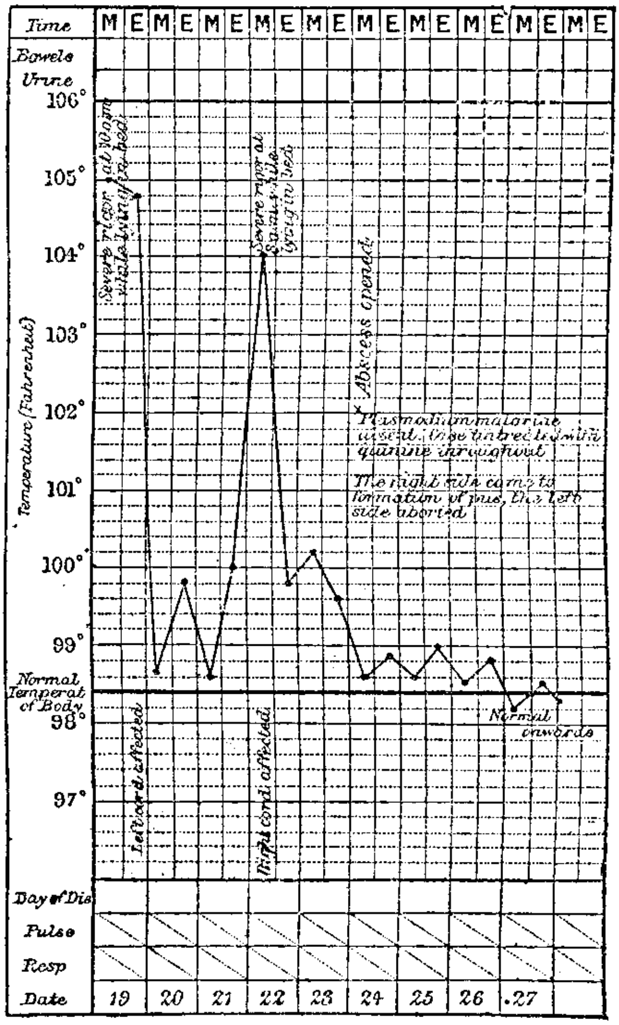


FIG. 8. Filarial abscess.

man of 45, who had previously suffered from filarial abscess and had lived a clean life, having had neither gonorrhœa nor syphilis, was suddenly seized with an attack of elephantoid fever. Filariæ were swarming in his blood at the time. On the next day his left testicle was swollen and intensely painful, the skin of the scrotum was red and swollen on the same side, and the constitutional symptoms were severe. So wretched did the man feel that he assured me he was going to die. The acute stage soon passed away under treatment, but the trouble was not quite cured for a month. In this case there was also lymphangitis of the spermatic cord. He has had one attack since, and the symptoms were about the same. Six months separated the two attacks.

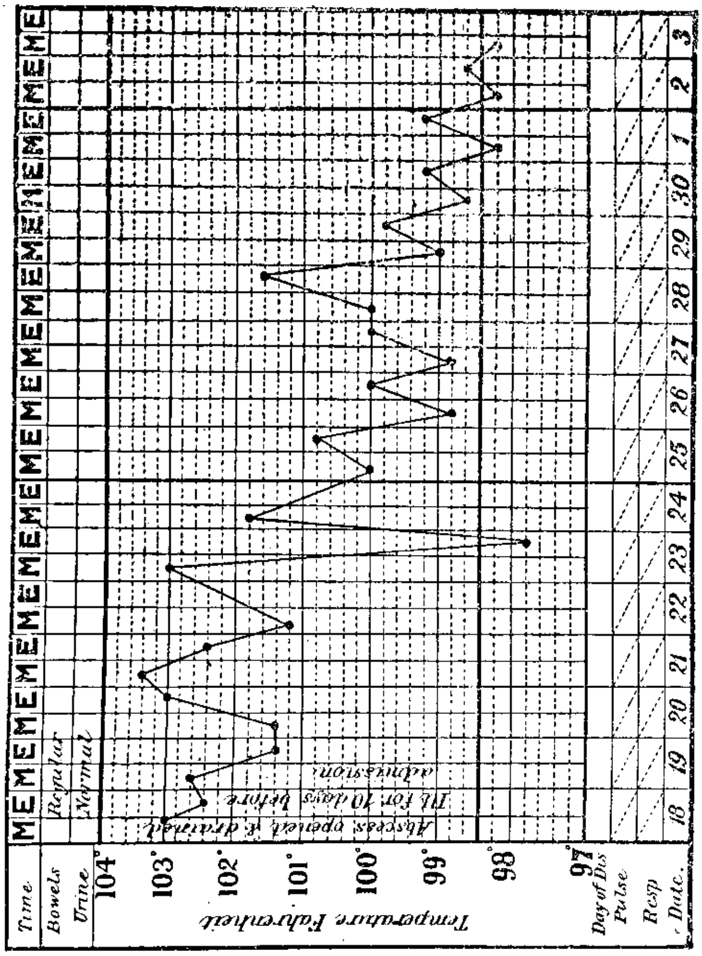


FIG. 4. Neglected case of filarial abscess.

In four years' practice in the coast belt, three well-marked cases of this kind have been seen. Nearly always when there is filarial abscess of the scrotum there is some accompanying orchitis, but the orchitis is secondary; it is not very severe, is amenable to treatment, and shows no tendency to recurrence. Tendency to recur is marked in the true uncomplicated form. In some cases it leaves behind it a thickening of the spermatic cord.

Its pathology is probably the same as that of the other diseases in this section; that is, inflammation in an area of lymphatic congestion. In operating on a case of filarial lymphatic varix, Moty(38) discovered several soft cysts on the surface of the testicle which was enlarged. There was also great thickening of the spermatic cord in this case.

The treatment of the disease is the same as that of ordinary orchitis, and strapping should be employed if the case becomes chronic. If there is much pain, puncture of the testicle with a fine tenotome gives great relief.

ACUTE ARTHRITIS OR SYNOVITIS

In cases of erysipelatoid inflammation, affecting a limb, for example, it is by no means uncommon to hear a complaint by the patient of pain in one of the proximate joints and, on examining the same, to find evidence of some synovitis present. As a rule, this synovitis is a negligible quantity and gets better without treatment; but in a few rare cases the inflammatory process is much more severe. The connection between acute synovitis of the knee joint and filarial infection has been pointed out by Maitland.(21) My own cases consisted of two kinds.

a. Cases where the infection almost certainly came from the outside and simply fastened itself on a previously inflamed joint.

b. Cases where the infection was part and parcel of the inflammation depending on the presence of the parasite.

As an illustration of the first kind, the following is of interest: A man with an old lymph scrotum, who had previously had erysipelatoid inflammation of the leg, with accompanying pain in the knee, came into the hospital for some troublesome internal hæmorrhoids, of which I ligatured two masses. He was operated upon in the morning. The same evening he had a smart attack of erysipelatoid inflammation of the right leg. Next morning he was complaining of his knee joint, which was distended with fluid. On the following day he was worse, and the joint was aspirated and turbid fluid was drawn off. This did not clear up the trouble, and two days later the joint was opened and drained. He made a good recovery with a movable joint.

One more case of this kind has come under my care. The same joint was affected, and the history was identical. In this case the affection followed an operation for fistula in ano. Recovery followed drainage of the joint, but the movements of the joint were far from perfect.

These cases are the only two, in a hospital practice of twenty years' duration, where infection of a joint has followed an everyday operation, and it is curious that both should have occurred in the subjects of filarial infection, filariæ being easily found in the blood. The usual antiseptic precautions were taken in both cases.

In regard to the second kind—that is, cases where the infection was part and parcel of the inflammation depending on the presence of the parasite—strange to say, in both cases seen the joint affected was the wrist joint. The first case was that of a man 40 years of age. He had a lymph scrotum, and his blood swarmed with filariæ. On February 21, 1902, he was attacked with erysipelatoid inflammation of the right arm and forearm. Three days later his right wrist joint had become very painful. He was treated in the usual way, and the inflammation subsided except around the wrist joint, which remained swollen and very tender. On March 6 he was put under chloroform, and the joint was explored through a palmar incision. A little turbid fluid came out, and the ends of the bones entering into the joint were rough. The incision was then closed, and the part was put up in plaster of Paris. This was kept on for a month, and then massage was applied. The patient made a perfect recovery, the movements of the joint being normal when he was last seen.

Guided by the last case the treatment of the second patient was modified considerably. He was a man of 50, who had suffered from lymph scrotum for twenty-five years. He was attacked in the same way as the first patient—if anything, more severely. There was marked grating in the joint, which was intensely painful. After the acute symptoms had subsided, the part was put up in a fixed apparatus, and the joint was soon well.

Acute rheumatism is not present in this region, and both patients were otherwise free from disease.

GANGRENE OF THE SCROTUM

Gangrene of the scrotum is not a common disease, especially if all cases of nephritis are excluded. Its occurrence in a healthy young man is sufficiently remarkable to call for special notice. Table 7 gives particulars of 8 cases seen during four years.

TABLE 7.—*Cases of gangrene of the scrotum.*

Initials.	Age.	Evidence of filarial disease.	Hydrocele.
	Years.		
O. T	40	Filarial embryos and varicose groin glands	Yes.
O. H.[a]	43	Old elephantoid fever; no embryos found	Yes.
T. L	23	Varicose groin glands; fever; no embryos found	Yes.
T. T.[a]	35	Elephantoid fever and occasional swelling of scrotum; no embryos found.	No.
L	41	Varicose groin glands; elephantoid fever	Yes.
C. K.	41	Elephantoid fever; no embryos found	No.
T	37	Varicose groin glands; no embryos found	Yes.
B	38	Elephantoid fever for many years; no embryos found	No.

[a] Slight erysipelatoid inflammation of the scrotum accompanying attacks.

The only common feature in these cases is that all had a history of filarial disease, past or present. They began in the same way; that is, with a sharp attack of fever, accompanied by redness and swelling of the lower half of the scrotum. This inflammation is from the first acute, and in a few days the lower half of the scrotum becomes black and comparatively dry. If left to itself, this gradually separates, and the exposed surface slowly heals. Healing may be hastened by skin grafting as soon as the surface is covered by healthy granulations.

Hydrocele, if present, may materially hinder the healing of the wound, and it must be tapped. If this is done with strict antiseptic precautions, there need be no fear of infecting the hydrocele. It should be tapped, of course, through healthy skin and not through the granulating surface.

It may be urged that these were malarial cases. While it is true that malarial gangrene is a well-known affection, in all these cases no evidence was obtained that would support this contention. Although none of them had been treated with quinine, the microscopical examination of the blood was entirely negative.

One point is worthy of note; namely, that of the eight cases only two had filariæ present in the blood. It is possible that in all such cases, however, the parent worm is present in the tissues that die, and that the death of the tissues is due to the inflammation set up by the death of the worm.

Another point worth noting is the little constitutional disturbance manifest in the patient after the initial sharp attack is over.

It may be urged that the evidence in favor of its being due to filarial infection is too slight. There is an important negative piece of evidence. I moved from Changpu, in the coast belt, to Yungchun, which is farther inland, and pari passu with the loss of practically all filariasis cases; gangrene of the scrotum became such a rarity that only one case was seen in twelve years, and the patient had resided for some time in the coast belt.

FILARIAL HÆMOPTYSIS

By filarial hæmoptysis is meant hæmorrhage from the lungs occurring in patients with filarial infection, correlated in time with an attack of filarial fever, with or without manifest evidence of lymphangitis.

In the case specially studied by me, there was a heavy filarial infection, and there was no manifest evidence of lymphangitis. It is known that during the day the filarial embryos have their habitat in the lungs; in the case that first directed my attention to the subject the hæmorrhages took place during the day, and live filarial embryos were present in the expectorated blood.

It may be said that the Chinese are very commonly subject to tuberculosis, and in the absence of post-mortems it is impossible to state that these hæmorrhages are not tubercular in origin. The only answer I can make is that the case here discussed has been under observation from time to time for the last twenty years; that the hæmorrhages only occurred when he was the subject of filarial infection (he became free from infection for several years during this time); that the sputum was carefully examined for tubercle bacilli many times with negative results; that examination of the chest was consistently negative; and that the patient never presented any symptom, save the hæmorrhage, that would suggest a tubercular infection.

I have never seen one of these cases die of the hæmorrhage. It may be of fair quantity, but it stops with the fall of the temperature and does not recur apart from a definite attack of filarial fever.

It is impossible to be dogmatic on the subject, but it is my conviction that the above diagnosis is correct, and this opinion is shared by both Dr. H. T. Whitney and Dr. J. H. Montgomery, of Fukien, who have had a large experience with filarial disease.

DISEASE DUE TO OBSTRUCTIVE INTERFERENCE WITH THE LYMPHATIC SYSTEM

In commencing this section on disease due to obstructive interference with the lymphatic system, it must be clearly understood that this division is an arbitrary one. While it is true in the main that the diseases of the one set are chiefly the result of inflammation, it must be borne in mind that there is at the same time, as a rule, lymphatic stasis in the affected part. On the other hand, although we speak of disease due to obstructive interference with the lymphatic system, it must be remembered that in the production of the lymphatic obstruction inflammation plays an important part. This point being clearly understood, we can turn to the consideration of details.

There are two main forms of filarial disease to be discussed under this section. Roughly speaking, the one is characterized by dilatation of the lymphatic, the other by the production of more or less solid œdema in addition to this dilatation. One of the main proofs that all of these diseases are due to the same cause is found in the fact that all grades of disease may be seen, from the small lymphatic varix to the most solid forms of elephantiasis.

How do these diseases originate? It cannot be said that it is always clear, and each case will be discussed in its proper section. The parent worm or worms may act as an embolus in one of the larger lymphatics, and may cause an attack of inflammation, or bleeding into the lumen, ending in the stenosis or occlusion of the vessel. The ova of the worm, if discharged prematurely, are probably able to block the smaller lymphatics, and are also able to block the circulation through the lymph glands. In either case a portion of the lymphatic system becomes wholly or in part cut off from the general lymphatic circulation. The pressure in this area rises, and varicosity of the lymphatics, or lymphatic œdema, or one of the many combinations of these two, results.

LYMPHATIC VARIX

The ramifications and anastomoses of the lymphatic system are fortunately very free, so that a compensatory circulation is not very difficult to establish. But in any case of lymphatic obstruction (especially if large trunks, such as the thoracic duct, are occluded) it takes a little time for this compensation to take place. Meanwhile the lymphatics of the occluded area are dilated, and lymphatic varix occurs. If the thoracic duct is occluded, then the chyle can only reach the general circulation by a retrograde route, and in consequence the abdominal and pelvic lymphatics become much dilated. Manson(29) speaks of these in the following terms:

> In dissections of such cases the thoracic duct has been found distended to the size of a finger, the abdominal and pelvic lymphatics forming an enormous varix, perhaps a foot in diameter and many inches in thickness, concealing kidneys, bladder, and spermatic cords. In such cases, when one of the vessels of the varix is pricked or ruptures, the contents are found to be white or pinkish. They are not limpid like ordinary lymph, they are chyle, therefore, chyle on its way to enter the circulation by a retrograde compensatory track.

Lymph scrotum, varicose groin glands, chyluria, and the like have as their basis a condition of lymphatic varix, but they are not pure lymphatic varices. They will be discussed under separate headings.

There are, however, cases of pure lymphatic varix that we must discuss as such. Occasionally one meets with cutaneous lymphatic varix. There are small swellings which, although sometimes permanent, are often evanescent. The kind described as "deeply-situated little swellings"(30) has been seen but once. On the other hand, I have sometimes met with groups of vesicles on the thigh, which might well fall under this category. They may occasionally form the starting point of a lymph fistula. The contents of these vesicles according to my experience are always clear fluid.

The deeper lymphatic varices are rarely seen, owing to the utter impossibility of obtaining post-mortems in inland China, but on one occasion a lymphatic varix of the spermatic cord was encountered when operating for the radical cure of hydrocele. In this case all of the lymphatics of the cord were dilated, and there were two or three small cystic dilatations on the lymphatic vessels. The contents were clear. No operation was performed on these dilated lymphatics, and the case convalesced like an ordinary radical cure. The patient had had elephantoid fever, and his blood contained many filarial embryos.

On another occasion I helped Dr. J. H. Montgomery to operate on a school boy, aged 16. In the right inguinal region there was a soft, compressible swelling, which enlarged when he stood up, and in which there was a marked impulse on coughing; on lying down it practically disappeared. The swelling turned out to be a lymphatic varix of considerable size situated in the inguinal canal. The lymph vessels were the size of a large quill and ran lymph on being wounded. The whole mass was removed, the vessels being tied as if they were a mass of varicose veins, and the patient made a good recovery.

On two occasions, when operating for elephantiasis of the scrotum, marked dilatation of the lymph vessels about the spermatic cord was seen over and above the general lymphatic dilatation seen in these cases.

As a rule, lymphatic varix is best let alone. If giving trouble, and if it is possible to remove the whole varix, this may be done; but it must be remembered that the varix is partly complementary, and any interference with it may involve the production of another varix elsewhere, or the formation of lymphatic fistula in some other part of the varicose area.

LYMPHATIC FISTULA

Under the heading of lymphatic fistula there are three varieties to be described—the spontaneous, the inflammatory, and the operative. The first forms spontaneously in an area already in a condition of lymphatic varix.

Spontaneous.—As an example may be adduced the case of a man, aged 23, the subject of filariasis. On the outer surface of the left thigh, rather toward the front of the limb and about its middle, was a small aperture from which lymph slowly drained away. A fine probe was passed in about a quarter of an inch (0.6 centimeter) inward and upward. There was no inflammation about the mouth of the fistula, the history of which was that it had formed spontaneously three days previously. Its appearance was preceded by a vesicle, and the lymph coming from it was transparent and free from blood.

This form is rarely seen, and the mouth of the fistula remains free from redness or swelling, unless secondary infection takes place. Unfortunately with native patients, who love to meddle with any aperture or wound, this almost always occurs, and then it becomes a septic sinus. Unless it is giving much trouble, it is best let alone, as its presence probably saves the patient from many attacks of elephantoid fever. In one case I cauterized and got the fistula to heal, but immediately the attacks of elephantoid fever, which had intermitted while the fistula was open, recurred.

Another patient presented a small, uninflamed aperture on the front of a small lymph scrotum. At times lymph would spout

out of the aperture to a distance of 6 inches (15 centimeters) and a test tube full of lymph could be collected in a short time. The strain on the patient was considerable, and I stopped the flow by surrounding the aperture with a purse-string suture of the finest horsehair. During the patient's stay in the hospital the flow did not recur.

The second variety follows the opening or bursting of a filarial abscess. It may for convenience be called inflammatory.

Inflammatory.—It is not at all uncommon, after the opening or bursting of a filarial abscess, for the patient to be troubled for some months by a lymph fistula in the site of the opening into the lymphatic abscess cavity. This sinus may be several centimeters deep, and it often runs down to the region of the lymphatics in connection with the large vessels of the limb. The usual site for a fistula of this kind is in the popliteal region. The abscess cavity closes up, leaving a fine sinus, through which lymph gradually trickles. Another favorite situation for this kind of fistula is in an elephantiasis scroti, an abscess forming in the elephantoid tissue, bursting, and leaving a lymphatic fistula.

As to treatment, in both regions it is better to do nothing in the first case because, given time, the fistula will almost certainly heal of itself; and in the second because the probability is that nothing short of removing the elephantiasis scroti will be of any avail. In some cases this also heals spontaneously, but this rarely occurs.

Under this class must also be included the ulcers of the leg occurring in elephantoid disease of this limb. These also act as fistulæ and are constantly moist with exuding lymph. They are very difficult to heal. A case is recalled of a man with both legs elephantoid and ulcers on one leg just above the ankle (Plate 21). As out-patient and in-patient I worked on him for three years, and finally gave up all treatment as hopeless. Although the ulcers diminished in size, they never showed any inclination to heal, and there was too much fibrous change about the ulcer to make it possible to do skin grafting with any reasonable hope of success. Besides, patients suffering from this affliction, although they wished to get their ulcers healed, yet confessed that the advent of the ulcer had almost entirely freed them from attacks of elephantoid fever.

The third class comprises those following operations.

Operative.—Temporary postoperative fistulæ are by no means uncommon. Twice in operating on varicose groin glands has the operation wound healed by first intention, except for a fine aperture at the lower end of the scar, which continued to run lymph for from a fortnight to three weeks. In the end, however, these fistulæ heal satisfactorily, and they may safely be let alone.

But it is sometimes otherwise with the fistulæ that may be left after operations for elephantiasis scroti. Occasionally the elephantoid change extends high up on the skin of the abdomen. In this case, particularly if the patient is well on in years, it is better to leave some of this diseased skin rather than make a huge operation wound. But this carries with it its own penalty, as it becomes necessary to operate through diseased tissues, which are notoriously difficult to heal. Then a fistulous opening is apt to occur in the region of the root of the penis. Twice this has occurred in my own patients: in the one case the fistula healed spontaneously, in the other case it was still open a year after the operation.

VARICOSE GROIN GLANDS

Where, in the course of the lymphatic varix, lymphatic glands occur, these participate in the general dilatation. In marked cases, on removal from the body, they may appear on section like a sponge. In other cases, especially where there have been many attacks of elephantoid fever with inflammation of the glands, they may be indurated, and there may be a great increase in the fibrous tissue forming the framework of the gland. Of these varicose glands by far the most important are those found in the groins of patients suffering from filarial disease.

These groin swellings may be found alone, or in association with other forms of filarial disease, notably with lymph scrotum, elephantiasis of leg or scrotum, chyluria, or chylous dropsy of the tunica vaginalis.

In a not inconsiderable number of cases the patient is quite unaware of their presence until they are discovered by the medical man. They are often quite painless and give no trouble whatever. In other cases the patient's attention is called to them by dragging or aching pains in the groin. The swellings vary much in size, from a slight enlargement to masses the size of a man's fist. In many cases the glands are discrete, but in the majority the lymphatics running into the gland are also dilated, and the whole forms a mass. All of the groin glands may form a large, ill-defined, matted swelling, inguinal and femoral glands being alike involved. One side only may be the seat of these swellings, but very frequently both sides are affected. In many cases the swelling is much smaller on one side than on the other.

The skin over these swellings is natural. In the case of the smaller swellings it is nonadherent, but if there has been inflammation about the glands, it may be difficult on operation to free it from the mass. The swellings themselves may be said to be adherent to the underlying fascia. A hypodermic syringe draws off lymph from these swellings, either clear or chylous, according to whether or not the varix is in connection with the chylous lymphatics. This fluid very often contains filarial embryos.

As to their diagnosis, it has been said that it is a common mistake to confuse these with herniæ. I have seen some two or three hundred cases, but have never seen one in which the slightest doubt on this head arose in my mind; and, with proper care in the examination of the swellings, this mistake should not occur. As there is often some other manifestation of filarial disease present, this may assist in diagnosis, if there is doubt. Masses of tubercular or lymphadenomatous glands might, if sufficient care be not taken, be mistaken for them, but there is one valuable positive sign that should greatly help: when the patient lies down with the buttocks raised, the tumors gradually get smaller, a condition that may be hastened by pressure with the hand; if the patient now stands up, the tumors gradually fill and become prominent. There is no impulse to speak of over these swellings. Manson (31) adds a hint that is a very wise one:

> Chronic swellings about the groin, cords, testes, and scrotum, in patients from the tropics should always be regarded as being possibly filarial.

Azema (1) has made the statement that these various glands may spontaneously disappear at or about the age of 40. It is difficult to see why this should be the case. I have never seen one spontaneously disappear, nor have I been able to get satisfactory evidence of this taking place. Certainly they generally do not, and many cases are seen after this period. Once I saw them appear for the first time in a woman of 64. She had come for dragging pains in the groins, accompanied by slight hæmaturia, for which no cause could be discovered. The hæmaturia ceased on the day of admission, leaving a urine in which nothing wrong could be discovered. Four months later she returned with markedly varicose groin glands, her blood full of the embryos, and it was clear that here was the explanation of her attack. Since that time she has had a distinct attack of chyluria, but not a severe one.

As to treatment, I agree with those who have had experience of the subject that it is advisable to let these glands alone unless they are causing a large amount of trouble; in troublesome cases, the glands may be safely removed.

Septic lymphangitis used to be greatly feared in these operations, and of course, unless care be taken, the operation is a dangerous one. No one who has not performed these operations can have any conception of the mass of dilated lymphatics, and these run when wounded and obscure the field of operation. As all the superficial veins and arteries are embedded in the mass, care must be taken, especially at the saphenous opening. The external saphenous vein is often a large one, and if cut just at the opening, it may be difficult to secure. As far as possible, the dilated lymphatics entering the mass should be ligatured, as this greatly diminishes the lymphorrhagia. The best material to employ for this purpose is fine catgut.

It must always be remembered that removal of these glands may precipitate an attack of chyluria or elephantiasis of the leg. An appearance of the beginning of elephantiasis of the leg, however, must not be taken as a certain sign that this trouble is going to supervene. In one patient I was much distressed to find that, a fortnight after the operation, the leg presented every appearance of commencing elephantiasis. It was swollen, and with a solid œdema affecting the skin in parts. Six months later the leg was perfectly normal, and it was clear that the condition was only temporary, due to the collateral circulation not having become fully established.

That the operation is very satisfactory in some cases is proved by the fact that the patient mentioned above came back in order to have a second operation on the opposite groin.

Rarely these varicose glands are met with in other exposed situations. One case of varicose axillary glands has been seen. In this case the mass was not very large.

In some cases the mass of glands forms the dwelling place of the parent worm.

If the glands are not removed, the daily painting of the skin over them with linimentum iodi seems to exert a beneficial effect. How it does this is not clear, but it certainly in many instances relieves the aching and dragging pain of which the patients frequently complain.

LYMPH SCROTUM

In a well-marked case of lymph scrotum the appearances are characteristic. The scrotum is swollen, and the natural rugosity of the skin is increased. This appearance is partly due to the fact that, during the attacks of elephantoid fever, the parts become very œdematous and partly to the condition of the skin itself. The latter is a little thickened, and the surface is covered with small vesicles. The whole is part of an extensive lymphatic varix involving the scrotum; and, as might be expected in these cases, the groin glands on both sides are often varicose, but this is not always so. In some cases it is only the scrotal skin that is affected.

The character of the fluid obtained from the vesicles varies with the site of the obstruction. If the obstruction is affecting the chyle vessels, the fluid will be chyle or sanguineous chyle; if not, it will be straw-colored only. When an acute attack supervenes, the vesicles on the skin, otherwise quite small, enlarge and become tense. If very carefully handled, the attack may pass off without any discharge of lymph; but, as a rule, the vesicles either spontaneously rupture or are broken by accident, and then lymph drains away. Sometimes it simply streams away, and I have collected an ounce (30 grams) in one and a half minutes from one opening.

The strain on the patient due to this constant flow is most trying, and I have seen a patient in a critical condition from sheer exhaustion due to this cause. Such acute cases are fortunately rare, and the main complaint that the patient makes is of discomfort due to his clothes being always in a wet condition.

Another point that should be borne in mind is that the discomfort of a lymph scrotum specially appears during or after an attack of lymph fever. Although the fever itself may have abated, there remains a recently inflamed lymphatic tract constituting a field of infection, ready to hand, in the area of scrotal lymphorrhagia. Occasionally most troublesome inflammation of the whole lymphatic region starts in this way, spreading into the superficial inguinal regions and then down the thighs fully halfway to the knees.

Erysipelatoid inflammation and elephantoid fever are common concomitants of lymph scrotum; and abscess, either preceding or accompanying the affection, is not rare. It must be remembered that all varieties of lymph scrotum are met with, from that in which the affection is just becoming manifest to that in which the scrotum is one mass of large vesicles.

Another very common type is that in which the scrotum is partly varicose and party elephantoid. This is particularly likely to be the case if the patient has suffered much from erysipelatoid inflammation in addition to the lymph scrotum. If, on the other hand, he has only suffered from elephantoid fever, and to a very limited extent from erysipelatoid inflammation, then the scrotum will remain a lymph scrotum to the end.

It is difficult to follow up these cases in the Far East but, as a rule, they take one of two roads: either they become elephantoid, in which case they may develop into large tumors like those scrota that are elephantoid from the beginning, or they remain varicose. In the latter event they tend, as the patient reaches to 50 years or more of age, to become atrophic. Some of the patients have had the disease for over thirty years.

Two cases were kept under observation for four years. In one, in spite of recurring attacks of elephantoid fever, the scrotum steadily shrunk. This patient was over 55 years of age. In the other case there were fewer attacks, but the erysipelatoid inflammation was more marked, and the scrotum double in size and was rapidly becoming an elephantiasis scroti.

Embryo filariæ are generally found in the blood in these cases, and very often they may be obtained from the lymph flowing from the scrotum. On one occasion, as mentioned on a previous page, filarial ova were found in the fluid from a scrotum of this kind, when repeated examination had failed to discover the embryo in the blood. In this case the fluid flowing from the varices was straw-colored, and the groin glands were not enlarged.

The past history of these cases varies greatly. Here is a patient who had suffered from elephantoid fever for at least fifteen years, and whose scrotum had only during the last year become a lymph scrotum. Here is another patient who, within six months of his first appearance of trouble due to the filaria, had developed a very marked condition of lymph scrotum; but as a rule a marked condition of lymph scrotum takes about a year to develop, and every degree of varicosity is produced. The largest varices are generally found near the root of the penis. Occasionally the testicles are a little thickened, especially if there has been an attack of filiarial orchitis. Also, single or double hydrocele may or may not be present.

Treatment may be divided into that of the acute attacks and that of the general condition. In acute attacks, the best place for the patient is in bed, with his scrotum supported at a higher level on a pillow. This simple proceeding often gives great relief. Strict cleanliness must be observed, and the scrotum must be treated by either a dry or a wet method. In the former it is dried and powdered with any antiseptic powder. A powder composed of zinc oxide, or a mixture of this with boracic acid, suits well. If a wet dressing is to be used and sometimes it suits a case much better than the dry one, lint kept continually wet with cold water or lotio plumbi subacetatis may be used. Occasionally a little opium added to the lotion is of advantage. Each case, however, must be treated on its merits.

Where the lymphorrhagia was very severe and mostly confined to a single spot, I have several times ligatured the lymphatic vessel, using a fine needle and horsehair, leaving the ligature in place for a day or two.

The treatment of the general condition raises large questions; for operation, though comparatively easy, involves the great risk of setting up trouble in some other part of the lymphatic area. Operation has been followed by the commencement of chyluria or elephantiasis of the leg. More than this, the wound is very large and takes a long time to heal, even if Thiersch grafting be employed. Six weeks to two months is not too long to estimate.

Supposing that operation has been decided upon, what operation should be performed? Manson(32) gives the following directions:

> The scrotum should be well dragged down by an assistant whilst the testes are pushed up out of the way of injury. A finger-knife is then passed through the scrotum and in sound tissues, just clear of the testes, and the mass excised by cutting backwards and forwards. No diseased tissue and hardly any flap should be left. Sufficient covering for the testes can be got by dragging on and if necessary dissecting up the skin on the thighs, which readily yields and affords ample covering. It is a very common but a very great mistake to remove too little. As a rule, the wound, if carefully stitched and dressed antiseptically, heals rapidly.

I am not in favor of this method, as in many cases it will fail to remove the whole disease, and the bleeding may be serious. I prefer an operation similar to the one undertaken in the following case:

A semicircular incision was made from side to side across and under the root of the penis and well up into each inguinal region. This incision was carried through the skin and underlying fascia, all vessels being clamped as cut. Two lateral incisions were then made from the extremities of this first incision on the lateral aspect of the scrotum from base to apex. The flap thus marked out was turned down, laying bare both testicles and their cords. These were freed and turned forward, the whole of the remainder of the scrotum being then cut away. The testicles were sewn in position to the wound in the perineum, and the skin from the lateral aspects of the thighs was drawn partially over them. Even though this was done, there still remained a wide, gaping wound which, in spite of Thiersch grafting, took six weeks to heal. The final result was very satisfactory, as the attacks of elephantoid fever ceased from that moment and had not recurred two and a half years later.

Many natives have asked for operation, but when they learned the time that they would have to stay in the hospital, they backed out, saying that the discomfort was not sufficient to make them give all that time to the cure. In the slight cases, it is not worth their while; and in the severe ones, there is no chance of obtaining flaps, a condition which greatly delays convalescence.

If it is decided not to operate, then the patient should be instructed to keep the parts scrupulously clean, suspended, and protected from undue friction between the thighs.

CHYLURIA

Fortunately for the subjects of filarial disease, chyluria is by no means common. It may begin in several ways. Sometimes it begins without warning and is the first indication to the patient that he is in any way out of health; but more often there are some premonitory symptoms, either in the form of dragging pain in the back or aching in the groins or hypogastric region. If the patient is at the same time the subject of one of the other forms of filarial disease, the onset may be heralded by the trouble pertaining to that form. For example, here is a man, the subject of lymph scrotum. In his case the first onset of the chyluria was associated with an attack of elephantoid fever and scrotal lymphorrhagia—and this is only natural; whatever raises the pressure in the already existing lymphatic varix is liable to precipitate the onset of chyluria.

The pathology of the affection is quite clear. Given a lymphatic varix in the wall of the bladder or in the region of the pelvis of the kidney, you have only to raise the pressure so that the dilated lymphatic ruptures in one or the other situation, and you have chyluria. This chyluria may be intermittent or permanent. In the intermittent cases the chyluria only occurs under provocation, such as is afforded by an attack of elephantoid fever, and in the intervals the urine is perfectly normal. It is important to bear this in mind, as the practitioner in a filarial region is sure, sooner or later, to meet with patients who complain of having passed bloody urine, in whom the urine is normal at time of consultation; in such cases the explanation is that they have had an attack of chyluria of sanguineous hue and, on questioning these patients carefully, the point may be elicited that they had an attack of fever at the time. In what have been called the intermittent cases the attack lasts a day or two at the longest.

The cases that have been called permanent are not truly so, for with rare exceptions the chyluria does not continue permanent through life; but it may last weeks or months at a time, then intermit, and at an uncertain and variable time reappear.

It must be remembered that the disappearance of the milky nature of the urine is not proof that the fistula is closed, as the urine may still contain proof of the lymphatic connection in the presence of albumen, lymph corpuscles, and a gelatinous clot.

Rarely, retention of urine from clot formation is the first sign of chyluria; and although it is true that in most cases this retention passes away spontaneously in the course of a few hours by the passage of the offending clots, yet their occurrence gives the patient much pain and inconvenience.

The general health of the subject of this disease is, on the whole, fairly good; but if the drain of chyle is severe, the patient may become anæmic, depressed, and melancholic.

The patient generally notices the color of the urine himself; but if its milky nature is not marked, the doctor may be the first to discover it in the course of a routine examination of his patient. The urine may be markedly milky, or pinkish, or red, and this color may vary widely in the course of a single day. It may pass from milkiness to limpidity in a couple of hours. The nature of the food taken also makes a great difference in the appearance of the urine, as will be noted in more detail when we come to speak of treatment.

What are the characters of chylous urine? As to odor, this may be best described as heavy and urinous. This urine decomposes very rapidly in hot climates. Whether decomposition would take place with the same rapidity in a cold climate is open to doubt, but I have no data on this point. It is said that the quantity of urine passed is in excess of the normal; but the quantity of urine passed, especially in a hot climate, depends so much on the amount of fluid taken, and the amount of the same lost by sweating, that it is impossible to make a definite statement on this point. The reaction and specific gravity also vary within wide limits.

If chylous urine is passed into a urine glass, in many cases the whole becomes coagulated within a very short time. This coagulum slowly contracts, becoming redder, denser, and more fibrous. The clot at first floats in a milky fluid, which in due time separates into three layers, consisting of a whitish pellicle on the surface, in the middle a thick stratum containing the coagulum in the meshes of which embryo filariæ can be usually found, and at the bottom a little reddish sediment which sometimes contains a few small clots of blood.

The main part of the fatty matter is contained in the middle layer in a granular condition. Microscopical examination shows the lowest stratum to contain lymphocytes, cells like red blood cells (and in some cases probably true red blood corpuscles), urinary epithelium, crystals, and a few filariæ. Of course, in some cases filarial embryos are absent, as in cases where, the parent worm having died, the lymphatic varix still persists. One good way of finding them is to centrifugalize the urine as soon as passed. This way has acted well in the few cases I have personally had to treat.

Ether shaken up with the urine removes the fat, and boiling the urine brings down the albumen that it contains.

Usually the urine is most chylous toward evening, and Manson(33) has clearly shown that the presence of the filaria in the urine is not regulated by the law of periodicity governing its presence in the blood.

Treatment is eminently unsatisfactory. It cannot be said that we have any drug that has been proved to have any effect whatever on the disease; nor is it clear what some of the drugs used are intended to do. If they are intended to kill the parent worm, their use may be very dangerous. Chyluria is not a disease that can be called dangerous to life, whereas a dead parent worm at the back of the abdomen is a very different matter. Personally I would rather keep the chyluria, if I were so unfornate as to acquire it. If it is intended to diminish the pressure in the lymphatic area, it is difficult to see how these drugs are going to accomplish the desired end. Those that have been specially recommended in the treatment of this disease are the following: Gallic and benzoic acids, thymol, beta-naphthol, methylene blue, glycerin, perchloride of iron, chromic acid, quinine, sodium salicylate, and ichthyol.

The best results in the treatment of the disease are to be obtained from general treatment. The patient should be placed in bed, and absolute rest should be prescribed; as the patient does not usually feel very ill, this absolute rest is by no means easy to obtain. The pelvis should be elevated, and the amount of food and drink should be restricted. The bowels should be well cleared out.

If a minimum of fatty and fluid food is administered, the milky character of the urine may quickly pass away. This does not necessarily mean that the fistula is closed, as I have previously stated; but very often, by the above treatment the fistula can be really got to close and remain closed, sometimes for many months.

The subjects of this affection should beware of excessive or very violent exercise, as it is probable that an attack may be precipitated in this way (see next section). Special care must be taken by women during pregnancy, as the extra strain of labor is not at all unlikely to bring on an attack in susceptible subjects.

Clots of large size form occasionally in the bladder and give much trouble in the way of retention. When this occurs they may be easily broken up with the aid of a metal catheter.

CHYLOUS DROPSY OF THE PERITONEUM

Chylous dropsy of the peritoneum is extremely rare. Winkel(45) records a case that was probably of this nature. The first serious symptom was the development of ascites. The fluid drawn off by tapping was of a milky character and contained what were probably filariæ. Afterward the patient developed swelling of the left leg, which gradually subsided. The ascites returning, she was again tapped, and fluid of the same character was drawn off. Two days later she died suddenly.

One case has come under my care. The patient was a man of middle age, who had suffered from elephantoid fever. After a wine party he went outside and "saw a demon." He was greatly frightened and ran all the way home, a distance of three-quarters of a mile (1.2 kilometers). He felt uneasy in the abdomen on reaching home, and by morning it was swollen. A week later he came to hospital. His abdomen was moderately swollen by free fluid. On tapping, milky fluid was drawn off, but no filaria was found in it. The patient refused treatment and left the hospital at once. He did not seem to be acutely ill. The fluid coagulated on standing, but not completely.

It is remarkable that this form of the disease is not more frequent. It is possible that small leakages take place more frequently than is known and that the peritoneum is able to dispose of such leakages without their actually causing ascites.

CHYLOUS DROPSY OF THE TUNICA VAGINALIS

Chylous dropsy of the tunica vaginalis is by no means as rare as chylous dropsy of the peritoneum. Presenting the characters of an ordinary hydrocele, with the one exception of translucency, it is very often undiscovered until tapped, when milky fluid flows through the cannula. This milky fluid generally contains many filariæ, quite out of proportion to what one might expect. Parent worms have never been found in one of these lymphoceles, which rarely attain great size. The fluid drawn off from one of these swellings does not always coagulate.

Lymphocele is usually associated with some other manifestation of filarial disease, such as lymph scrotum, varicose groin glands, or elephantoid fever.

It should be treated as an ordinary hydrocele. If not large, it may be let alone or treated by excision of the sac. This is a much safer way than injection. Certainly, if a case of this kind were to go wrong after injection, it would be much more serious than in the case of an ordinary hydrocele, owing to the varicosity of the lymphatics. This raises the whole subject of the relation of ordinary hydrocele to filarial disease. Manson, (34) years ago, suggested that the great frequency of hydrocele in tropical countries might be due to the presence of filarial disease, and James(16) advances the same view and gives a few points bearing on the subject. The matter is not yet cleared up, and from what I have observed I doubt that filarial infection is the cause of more than a small percentage of cases. Out of the last series of Charles's(7) elephantiasis operation cases, eighty in number, fifty-nine suffered from hydrocele. Of my own operation cases, every one suffered from hydrocele, small or large, so that I may justly say that in elephantiasis cases hydrocele is the rule and not the exception. Of course, it may be alleged that this is a secondary matter, and primarily not due to the filarial disease, but to the elephantoid change in the tissues. Excluding these cases, certainly not above 10 per cent of the hydroceles in the coast belt with which I have had to deal by tapping or other operation have been the subjects of filarial infection. When compared with the figures given for general incidence, it must be admitted that the filarial disease, barring the elephantoid form, does not seem to be especially prone to give rise to hydrocele.

CHYLOUS DIARRHŒA

Chylous diarrhœa is extremely rare, and I have never seen a case. As the lymphatic varix must extend in some cases into the wall of the bowel, it is by no means an unexplainable trouble. As such cases are only a curiosity, they need not detain us further.

We have now to discuss the forms characterized by the production of more or less solid œdema in the parts affected, in addition to the lymphatic dilatation that characterizes all the affections that I have grouped under this section.

Not so very long ago it was necessary to enter into elaborate reasons which would justify the placing of the diseases characterized by solid œdema among the filarial diseases at all. Happily, with the advance of knowledge, this is no longer necessary; still, it is well to bear in mind the main reasons that justify this classification. It is true that not all cases of elephantiasis are connected with filarial disease and that, while the most common cause, it is not the only one. In the East and in Europe cases occur that have nothing to do with filarial disease and yet are as pronounced cases of elephantiasis as one could wish to meet; but, on the whole, it may be fairly stated that the elephantiasis of China is due to filarial disease, for the following reasons:

a. The distribution of filarial disease and elephantiasis are the same. Generally speaking, where there is no filaria, there is practically no elephantiasis, and vice versa. After a period of work in the coast belt of Fukien, I moved inland to a place well outside the belt. Here filariasis was absent, and the few cases of elephantiasis of the leg that came to me were either frankly due to other causes or were cases that had originated in the coast belt.

b. Every gradation between lymph scrotum—which is clearly a filarial disease—and elephantiasis scroti can be observed.

c. Both lymph scrotum and elephantiasis scroti are lymphatic varices.

d. The type of fever observed in undoubted filarial cases and elephantiasis cases is precisely the same.

e. The removal of a lymph scrotum or varicose groin glands—both manifestly filarial diseases—may be followed by the development of a form of elephantoid disease, either elephantiasis of scrotum or leg.

f. Acknowledged filarial disease and elephantiasis may and often do occur in the same subject.

Before taking up these diseases in detail, it will be well to discuss their pathology; and it must be freely conceded that in the majority of cases filariæ will not be found in the peripheral blood. Probably this is due to one of two causes: either to the death of the parasite or to the blocking of the lymphatics draining any affected area, so that the filariæ cannot make their way into the blood. The solid œdema characterizing the disease is brought about not by the mere obstruction of the lymphatics, but by a combination of this with inflammation set up in the blocked area. But what causes the blockage? First there is the action of the parent worm, which, from injury or some other cause, may abort. The ova then either block the lymphatics or obstruct the glands of the area in question, producing a lymph stasis. In this area, already in a condition of lymph stasis, inflammation takes place, and an abscess may form which destroys the lymphatics in its vicinity. Probably this plays a much greater part in the production of elephantiasis scroti than is supposed, and it is the common thing in Fukien to be able to elicit from elephantiasis patients a history of abscess in the scrotum, often the first sign of trouble in that part. To this are superadded frequent attacks of erysipelatoid inflammation, each attack aiding in the production of the permanently thickened condition of the tissues. In the case of the scrotum it will be observed that the tumor increases in size very slowly, up to a certain point, and then increases at a much more rapid rate. This phenomenon is due to the accident of position. As long as the scrotal tissues are able to support the weight, the tumor remains braced up, so to speak. As soon as the tumor reaches a certain size, the tissues yield and relax. The weight of the tumor then comes into play, and all the lymphatics passing over the upper edge of the pubis are further obstructed.

In the case of the leg, the dependent position of the part plays no small share in the production of the enlargement, and in an operation case of my own the forced rest involved by the operation for elephantiasis scroti sufficed to reduce the leg temporarily to a third of its former size. When one cuts into an elephantoid mass such as is found in elephantiasis scroti, after traversing the greatly hypertrophied skin, the subdermal tissues are found to be also much thickened, and the dilated lymphatics are easily made out; below this again is a mass of blubbery tissue containing much fluid, and this is easily traversed by the finger.

The rarity of elephantiasis of the upper parts of the body is explained by the rare lodgment of the parasite in these regions and by the free anastomosis of the lymphatics in these parts.

We come now to a discussion of erysipelatoid inflammation, which plays a large part in the formation of a fully developed case of elephantiasis of the leg. There are two views generally held. Many hold that the essential cause is a low form of streptococcic infection superadded on a limb that is already the subject of lymph stasis. Those who hold this view are unwilling to concede that the filaria plays any active rôle at all, and some deny even the passive rôle referred to above.(37)

Others, including myself, are convinced that elephantiasis of the leg is infinitely more common in filaria-infected regions than in those free from the infection, and are not convinced that the filaria plays a merely passive rôle in the production of lymph stasis and the subsequent elephantoid development, holding that the results of bacteriological examination of the tissues are not conclusive and that the inflammatory attacks may be due to a poison generated in the body itself. Why, for instance, should a case of lymphatic stasis due to sloughing of the glands in a case of plague be practically free from the constant inflammatory attacks common in a filarial case, and why should a lymphatic fistula ward off these inflammatory attacks in a filarial case without preventing the slow increase in the size of the parts below the fistula? More investigation is badly needed in these cases, both of the exact nature of the obstruction and of the nature of these erysipelatoid attacks, before the question can be deemed to be satisfactorily settled.

ELEPHANTIASIS SCROTI

Elephantiasis scroti generally begins with attacks of elephantoid fever combined with erysipelatous inflammation of the scrotum. The part becomes swollen and œdematous, and hydrocele not infrequently makes its appearance. The acute attack subsides, but leaves behind a legacy in the shape of some permanent thickening and enlargement. This process recurs and is varied perhaps by the occurrence of suppuration in the scrotum. In whatever way started, the thickening tends progressively to increase, and occasionally there are only a few attacks of fever throughout the whole disease.

The disease is not uncommon in the coast belt, but as a rule the tumors are not of large size; and so little trouble do the

As to the position of the patient, the lithotomy position maintained by a Clover's crutch or leg-rests should be used. This is by far the most convenient. When operating on a patient the subject of hernia, the hernia is best dealt with first by the usual incision, with the patient lying on his back. Thereafter the patient is put into the lithotomy position for the removal of the scrotum. During the general preparation of the patient, the bowels should be well cleared out with an effective purgative, best given on the second evening before operation, so as to ensure the patient's getting an undisturbed night before the event. Any cough should be treated, and the heart and urine examined in the routine way. It is difficult to give definite advice about operation on opium smokers, such a habit adding considerably to the risk of any large operation. Those who smoke heavily should be compelled to break it off before operation; otherwise the operator will have no end of trouble with them afterward. Patients who are the subjects of malarial cachexia should be guarded from unnecessary danger by previous suitable treatment.

I never kept the patient in bed before the operation, believing that the gain in the reduction in size of the tumor is little compared with the depression arising from the concentration of the patient's mind on his complaint and on the operation, which he naturally dreads. So he is allowed to do as he likes until the night before the operation.

Anatomy of the parts in question.—It must be borne in mind that all the vessels are greatly increased in size, and for this reason vessels that are otherwise quite unimportant may become serious sources of hæmorrhage.

The important vessels are the following:

Superficial vessels: Superior external pudic vessels.
Deep or inferior external pudic vessels.
Sciatic vessels, muscular branches.
Superficial perineal vessels.
Cremasteric vessels.
Dorsal vessels of the penis.
Artery of the frenum.
Inferior hæmorrhoidal vessels, if the skin has to be removed to near the region of the anus.
Deep vessels: Branches of the internal pudic vessel.

These should be looked for and found in their proper situations. The dorsal vein of the penis should not be cut.

The nerves and their positions may be entirely disregarded. Nerves, however, should be cut short, and not left hanging in the large wound.

The lymphatics, also, may be disregarded; but, if large and gaping, they should be tied.

So much for the anatomy of the part. Now we must discuss a most important question. Is a tourniquet to be used or not?

Use of a tourniquet.—Many urge the use of a tourniquet in order to save loss of blood, but the oozing in such cases after operation is frequently severe and troublesome. On the other hand, if a tourniquet is not used, the primary loss of blood may be severe. On the whole, I think the best advice is that if the surgeon is afraid of the primary hæmorrhage he should use a tourniquet, but if he is familiar with the anatomy of the area and is a fairly rapid operator, he will do better without. In the earlier cases I always used the tourniquet, but in later cases I did not; and since discontinuing its use I have had none of the unpleasant after-bleeding that was experienced in one or two of the earlier cases.

Another disadvantage in the tourniquet as applied by McLeod's(23) or Manson's method is that there is a constricting band around the abdomen, a thing that is objectionable, as it probably increases the danger of the anæsthetic. If a tourniquet is to be used, it is best applied in the following way:

Across the neck of the tumor is laid a long, sterile calico bandage from the right arm to the left foot. Behind, the same thing is done from the left arm to the right foot. The tumor and the two lower ends of bandage are held up and a piece of quarter inch drainage tube is carried around the neck and the bandages in a circular manner and tied securely. The lower end of the bandage in front is then turned upward toward the left arm, and the lower end of the bandage behind is turned up toward the right arm. The two ends toward the left arm and the two ends toward the right arm are held by an assistant on each side and so maintain the tourniquet in position. The tourniquet and bandages are, of course, carefully sterilized. This method obviates the necessity of having a tight band around the abdomen.

Incisions.—Hard and fast rules should not be laid down as applying to every case. For instance, in one case in which the skin of the penis was normal, the whole of it was left and after two years the skin was still perfectly sound.

Again it used to be urged that all diseased skin should be removed. If, as sometimes happens, the skin of the anterior abdominal wall is extensively involved, to remove the whole skin of this region is to make a huge wound without any real advantage to the patient.

Again a man of 60 years should not be treated like a man of from 25 to 30 years. In the latter case, to leave unhealthy skin is to court recurrence; in the former, it is most unlikely that there will be anything of the kind, and the attention of the surgeon should be rather drawn in the case of the older man to the provision of flaps, so as to insure a quick recovery.

The same discretion must be shown in dealing with the testicles. In a young man these must be certainly preserved, but in an old man, if atrophied, and their removal will facilitate healing, one or both may be removed. In a case complicated with hernia, it is good practice to remove the testicle on the side of the hernia. One can then be sure of closing the abdominal wall securely, and in this case there is the additional advantage that the operation is thereby shortened.

Speaking generally, I use two main forms of incision, one when using a tourniquet and another when operating without it. When not using a tourniquet, the incisions are made as follows:

The first is in the median line from the region over the pubis to the urinary orifice. Generally, as the tumor grows, the prepuce is inverted, and the glans may be several inches (centimeters) from the external orifice. A finger of the left hand is inserted into this orifice, and the incision is rapidly deepened. It is very easy to tell when one has exposed the penis. Using a pair of scissors, and with the aid of one's finger as a director, the prepuce is opened along the dorsum as far as the glans. All smegma is carefully cleaned away, and the lining membrane of the prepuce is dissected off and left attached to the glans penis.

The penis is now to be thoroughly separated from its surroundings from the suspensory ligament outward, taking care, below, not to cut the artery of the frænum. If it is wounded, it is better to ligature it at once. Above, care must be taken of the vessels on the dorsum of the penis, the vein being always very large. If due care is taken, it ought not to be wounded. The penis, having been separated, should be wrapped in gauze and turned upward.

The tumor is now pulled well over to the left, and beginning over the right external abdominal ring, a lateral flap is marked out, the incision ending in the middle line in front of the anus. The upper portion of this incision is now deepened, the vessels being picked up as cut. The external pudics will both be secured in this way. The skin left in this flap should be soft and pliable, and no œdematous, subcutaneous tissue should be left if it can possibly be helped. This incision and proceeding are repeated in the same manner on the other side of the tumor.

The upper ends of these incisions are now joined by a straight transverse incision, which crosses the upper end of that which has been used for separating out the penis.

A free incision is now made over one of the testicles, beginning from one of the lateral incisions near the external abdominal ring. This is rapidly deepened till soft, œdematous tissue is reached, when the knife is laid aside and the fingers are inserted. With their aid, the œdematous tissue, which runs with fluid, is torn open, and the testicle and cord are isolated. It is better to isolate the testicle first, as it is more easily found; the cord is not infrequently much expanded. The gubernaculum testis is in these cases very strong, and must be cut away with scissors or knife. The testicle is frequently compressed and deformed, and the cord is much lengthened, but this lengthened condition of cord soon corrects itself and needs no special treatment. If the testicle is hopelessly atrophied, then it is as well removed.

Charles(8) speaks of congestion of the head of the epididymis, or fibrous induration of the same, in cases attended with hydrocele. I have looked for this and have not been able to satisfy myself on the point.

The testicle having been freed, if there is a hydrocele, it should be cut open and the sac cut away, except a strip, which is left attached to the cord. The same procedure having been repeated on the other side, the testicles with their cords are then wrapped in gauze and turned up on the abdominal wall.

The incisions already made for the flaps are now to be rapidly deepened, and the whole mass is cut away from above, all vessels being clamped as cut.

Some operators advise arresting hæmorrhage by the clamp torsion method. I always ligature the vessels, using fine catgut. It is better not to employ silk for these large tumors as, owing to the impossibility of complete disinfection of the skin, infection of the wound is by no means unknown, and in such case the silk ligatures may give trouble. The number of vessels requiring ligatures is often very great, from forty to sixty ligatures being sometimes needed.

All bleeding having been arrested and clot sponged away, the testicles should be fixed in place by a stitch or two to the perineum. If the cord is very long, this too is secured in its proper situation by the same method. The flaps are now drawn over the testicles from each side and are fastened together by stitches of silkworm gut. If they do not come easily together, this may be facilitated by freeing the skin flaps at their attachment to the thigh, using knife and finger for the purpose.

A gauze drain should be inserted from the region of the base of the penis, bringing the end out at the lower extremity of the wound. This drain is removed in from twelve to twenty-four hours from the time of operation.

The penis is now drawn well forward, and the skin of the flaps is stitched to its base, the sutures going deeper than the cellular tissue and getting hold of the fibrous coat beneath. The lining membrane of the prepuce is also turned back and is used to cover a portion of the penis. The rest of the wound is sewn together with silkworm-gut sutures, and the operation is complete.

When using a tourniquet, it is well to commence with the median incision, then separate out the two testicles through two incisions down the front of the scrotum and, lastly, make the flaps and join the incisions.

Dressings.—Sterile gauze soaked in biniodide of mercury lotion, 1 to 4,000, is a good dressing. This is wrung out and is allowed to fall and arrange itself on either side of the penis, which is bandaged separately with gauze of the same kind. Oiled silk is extremely difficult to keep in good condition in the East. The dressing must be large, pass out on to both thighs, and fit well around the root of the penis.

The bandaging is an important and difficult matter. A bandaging block is an advantage. Calico is too stiff a material for the bandage; it should be made of a softer substance. What is called a water bandage does admirably. It must be put on in the form of a double spica, crossing and recrossing the perineum, and must be firmly fastened at the dangerous angles with safety pins. Especial care should be taken of the penis and the part just in front of the anus, which are the most liable spots for septic infection.

After treatment.—The patient must be placed in bed, and his knees should be tied together. There is no need to keep him absolutely at rest on his back; he may be allowed to lie in any way most comfortable. For the first twelve hours he should have nothing but a little very hot water to sip; rice water may be given for the next twenty-four hours, and after that whatever food he likes, within reason. The English method of after operative feeding does not suit the Chinese, and as a rule they flatly refuse such things as beef tea. Under the treatment given above they do very well. Usually they do not suffer severely from shock, but it is not true to say that this can be excluded, for occasionally severe shock may manifest itself; this shock is to be treated in exactly the same way as in England by strychnine, pituitrin, warmth, stimulants, posture, and saline infusion if necessary.

As has been previously said, the drain of gauze is to be removed from the lower part of the wound at the end of from twelve to twenty-four hours. If the flaps have been sufficient to cover everything, and all goes well, the wound need not be touched for seven days, when it will be found to be healed. The gauze about the penis should be removed by careful soaking, and the surface should be grafted, if need be, by Thiersch's method. Great care must be taken to avoid the binding down of the penis by cicatricial bands. The bowels should be opened by a laxative on the third day. Under favorable circumstances, healing should be complete within the month. Complications that may attend the convalescence are discussed in the following paragraphs.

Retention of urine.—This generally occurs at once, if it is going to occur at all. It is best treated by the passing of a soft rubber catheter, and after the first twelve hours the patient may be allowed to stand up to pass water. Occasionally, if the wound becomes septic, there may be a little difficulty, but it rarely needs instrumental relief.

Recurrent hæmorrhage.—This is a most troublesome complication when it does occur, and it is interesting to note that it hardly ever occurs except in patients in whose cases the tourniquet has been used. On one occasion I had to get up in the middle of the night, open the wound, and tie no fewer than twelve bleeding points. It is true, however, that this man had been unusually restless. In another case a hæmatoma that had formed over the upper part of the right cord and was becoming septic had to be evacuated. True secondary hæmorrhage I have never seen in these cases.

Œdema of the glans penis.—This is very liable to occur if care is not taken in bandaging the organ; but, when it does, the bandage must be taken off and reapplied.

Troublesome erections.—These sometimes occur, and they are a source of annoyance to the patient. If ice can be obtained—an impossibility in Fukien except in the coast ports—then an ice bag may be applied to the perineum. One useful plan is to insist on the patient emptying his bladder before sleeping, also whenever he wakes during the night, and to forbid him to sleep on his back. My experience of bromide and similar powders is distinctly disappointing.

Irritation of the skin.—This sometimes occurs as a result of the antiseptics used, helped also by the amount of scrubbing that the skin has had to undergo in order to make it anything like clean. It must be treated by powdering the surface with zinc oxide and changing the dressings for others that are less irritating.

Fever.—There are four causes of fever for which one must always be on the lookout. The first is malaria. In the southern region, where practically every one carries the plasmodium about with him, it is wise to give the patient a course of quinine before the operation. If this has not been done, then it is not at all unlikely that the shock of the operation will bring on an attack, in which case *Plasmodium malariæ* will be found in the blood. It is generally an atypical form of fever.

The second cause of fever is filarial. One of my cases had such an attack on the second day after operation. In this case the skin of the penis had been left untouched, and the erysipelatoid inflammation [8] of this part was well marked. Almost the whole wound healed by first intention, and the attack did not appear to have delayed convalescence. The patient's blood was swarming with filariæ at the time. Such an attack should be treated on general principles.

The third cause of fever is sepsis and need not be described, as it follows the usual course and presents the usual signs. If it occurs, a sharp lookout must be kept for an abscess or a suppurating hæmatoma, and free drainage must be provided.

---

[8] This typical erysipelatoid inflammation, if due to a streptococcal infection from the outside, should have produced much more serious results in this case.

The fourth cause of fever is pneumonia. The utmost care must be taken at the time of operation that the patient does not get chilled. If he should be so unfortunate as to get pneumonia, the case must be carefully watched and treated on ordinary principles.

So much for the complications of convalescence, but there are yet to be discussed the complications of operation.

Hernia.—In the principal writings on elephantiasis scroti, so little notice is taken of this complication that one is led to believe it does not greatly increase the risk of operation. It is nearer the truth to say that a large hernia is the most serious complication one can meet, for two reasons: first, that it is sometimes difficult to tell the size and contents of the hernia, owing to the thickness and hardness of the skin covering the parts; and, secondly, because the dragging of the tumor on the muscles of the abdominal wall, combined with the length of time the hernia has been down, has diminished the capacity of the abdomen, leaving little room for reduction.

It may be that I have been extremely unfortunate in the cases that I have had, but two of them gave me an anxious time. The first was a case in which there was a right inguinal hernia that had existed for years and was apparently reducible. Radical cure was performed on that side, the right testicle being removed and the scrotum amputated. Great difficulty was experienced in reducing the bowel, and the abdomen when the wound was sewn up was as tight as a drum. This case did well after looking unfavorable for the first few days.

The second case was more unfortunate. The patient was a man of 44 years, with elephantiasis scroti which weighed, after removal, 18 pounds (8.2 kilograms). He had a large right inguinal hernia, the size of which was hard to estimate accurately, owing to the very thick skin that extended well up on the abdominal wall. I was strongly of the opinion that it was not all reducible, and, owing to the risk, was rather unwilling to operate. However, the man was unable to work, and he was urgent in his request that the operation should be done at all risks; so it was finally undertaken. I found myself confronted with a huge hernia, in which some of the bowel had evidently been long out of the abdomen. After removing 0.5 pound (0.226 kilogram) of omentum, and puncturing the bowel in three places to let out gas, it was reduced, but the abdomen was so tight that there was danger of the stitches giving way. For three days the patient did well, then rapidly collapsed and died. It was not typical peritonitis, and the puncture holes into the bowel had been carefully closed with Lembert sutures; but as no postmortem was possible, it was impossible to learn the precise cause of death. Probably it would have been better to have excised the bowel; but after the experience of these two cases it is clear that the complication of hernia may be a serious one, and one which should call for great care in prognosis.

Hydrocele.—As has been previously stated, the common thing is to find hydrocele, and sometimes it is very large. It does not complicate the case in any serious way and is treated by excision of the sac in the usual method. The thickness of its wall varies greatly, from the almost normal condition to one in which the whole sac is much thickened. Occasionally this thickening is irregular.

Besides the ordinary form of hydrocele, there are found what are called hydroceles of the cord. When present these are to be treated by opening them and cutting away part of the wall. They are of little importance.

Varicocele.—This is not common, but is occasionally met with; in such a case the veins should be tied, and a portion should be excised in the usual way.

Cysts.—These are occasionally met with in the body of the tumor. They are generally smooth-walled, irregular spaces, and may commence in the rupture of some dilated lymphatics or may be the remnants of some old lymph abscess cavity. In a case in which I found one, it was directly beneath the scar of an old abscess. They are merely curiosities and do not affect treatment.

Complicated cases.—Under this heading may be included a case like the following: The patient came to the hospital in a miserable condition, with an elephantiasis scroti of some 10 pounds (4.5 kilograms) in weight, a bad stricture of the urethra, a right scrotal hernia, and several urinary fistulæ. The procedure adopted by me was to operate on the hernia by an incision placed well up on the abdominal wall, accomplishing a radical cure, and tying and severing the cord and pushing down the lower end into the scrotum. A week later the patient was put into the lithotomy position, and the scrotum was amputated, the right testicle being removed with the mass, and the left one shelled out. The stricture was now divided by an external urethrotomy, and a metal, full-sized catheter was tied in. All the fistulæ were followed up to their origin, and the left testicle was sewed in position and covered by a flap from the thigh. The penis, which was little affected, was let alone. The patient made an excellent recovery and left the hospital with one tiny fistula in the scrotum and was able to pass his water by the proper channel. He had been taught before discharge to use a full-sized, metal sound. A year later he had completely recovered.

What is the result of operations for elephantiasis scroti? It can be definitely stated that the results are very satisfactory. As a rule, the disease, if effectively treated, shows no tendency to recur. The first patient I treated has had two children since the operation. One of these was premature and only survived its birth a few hours, but the second was a healthy, full-term child.

In another case the patient unfortunately was left with a lymphatic fistula at the root of the penis. In this case the patient was old (63 years), and the elephantoid disease had affected the skin of the abdomen as far as the umbilicus, so that part of the operation had to be carried out through diseased tissues. Under these conditions it is hardly surprising that a fistula should be left.

These favorable results are corroborated by the experience of others.

ELEPHANTIASIS VULVÆ

Elephantiasis vulvæ is a rare disease. It may attack the whole of the external genitals or some one of their various parts. In the latter case the labia majora or the labia minora or the prepuce may be affected. There are two main types to be distinguished. In the one case the disease is sessile, corresponding to the broad-necked form of elephantiasis scroti. In the case illustrated (Plate 22, fig. 2), the disease had lasted for some ten years. The patient had acquired it in the coast belt and when seen was also suffering from malignant disease of the base of the bladder. Sometimes it involves the two labiæ, and as a rule the sessile form, if it needs operation at all, can be removed by an incision going clear of the growth on both the outer and inner side. It must be borne in mind that a form of elephantiasis vulvæ, having nothing to do with filarial disease, is by no means so rare. This is due to venereal infection and is generally small in size; its ætiology is not obscure.

The other type is a rarer one, where, a portion of the vulva being affected, this local trouble is accentuated by posture, and the whole forms a pendulous mass from the region of one or the other labium, varying in size, and comparable with the narrow-necked form of elephantiasis scroti. Plates 23 and 24 show cases of this kind well. The patients lived in the coast belt and had masses of filarial groin glands, which can be seen in the photograph of one case (Plate 24).

In this form of the disease, operation is simple and consists of amputating the tumor through the neck. The only point especially important is to note that the vessels are stretched and should be picked up and tied before they retract.

Charles (9) recommends that a catheter be introduced into the bladder before the operation and be retained there, in order to prevent the wound being douched with urine during or after the operation. Of course, the operation must be conducted under strictly antiseptic precautions. Recovery is generally rapid and satisfactory.

ELEPHANTIASIS OF THE LEGS

Elephantiasis of the legs may effect one or both legs and is, as a rule, much more marked below the knee, although the lower part of the thigh is often affected at the same time. Very rarely the thigh is affected before the leg, and I have seen at least one good example of this condition. The pathology and history of the growth of the legs are much the same as those of the scrotum. Very frequently the glands of both groins are varicose, even though the elephantiasis is confined to one leg.

The muscles of the part are frequently atrophied from pressure, constriction, and disuse. They are also said to undergo fatty degeneration from a like cause. The vessels are enlarged, and their coats are thickened. The bones may be thickened and have osteophytic growths; more rarely they are atrophied. The skin is very coarse, does not sweat at all readily, and is often ulcerated, especially about the ankle, where in a normal case of elephantiasis there is a constriction permitting of movement of the joint. The leg may attain an enormous size, having been found as much as 24 inches (61 centimeters) around the ankle. Still it is surprising how active some of these patients remain; for example, a patient, a horse keeper whom I used frequently to employ, whose leg was not less than 16 inches (40.5 centimeters) in circumference, and who had been in hospital for abscess in the leg and for filarial fever. Yet he has walked 12 miles (19.3 kilometers) after his ponies without any difficulty, and that over rough mountain paths. This for a man of 54 years of age cannot be considered a poor performance.

It must be remembered that an abscess in the leg may be the first sign of filarial disease, and it is not infrequent for abscesses to form in the already elephantoid leg; these may give much trouble, owing to their tendency to form lymph fistulæ. In like manner they are prone to become the seat of intractable ulcers, which, however, act as lymph fistulæ and so save their owners a number of attacks of elephantoid fever.

Before treatment, one should determine how much inconvenience the patient really suffers. In many cases it is not much, and it is as well in such cases to do nothing. If a leg is badly ulcerated in addition, it may be amputated, but this should rarely be done. I have had to advise it in only one instance, where the limb was deformed and ulcerated. Ligature of the femoral artery has been practiced; but, besides being useless, it may be followed by gangrene, and is therefore unjustifiable. Electrolysis has also been used, but it is of no use whatever. Aseptic puncture during the acute attacks of erysipelatoid inflammation has been performed with good results, but the benefit is only temporary; unless done with great care and antiseptic precautions, it may be followed by ulceration or a lymph fistula.

The main treatment is prophylactic, and the part should be carefully kept from injuries, such as wounds, insect bites, and scratches by thorns. If possible, the patient should give up work that involves wading in water, with bare legs exposed to the sun. If ulceration is already present, it should be prevented from spreading over a large area by antiseptic dressing.

In some cases a spell in bed with the limb slightly raised and the use of an elastic bandage will greatly lessen the size of the limb. In other cases the constant use of an elastic bandage helps the patient.

In serious surgical treatment, there are several operations that have been tried and abandoned.

Decortication of the limb with subsequent Thiersch grafting has been performed. Although in some instances the huge wound so formed has been induced to heal, the surface broke down again, and intractable ulceration and contracture followed, necessitating the removal of the limb.

Longitudinal strips of skin have been dissected off the fascia, but here again the procedure proved of doubtful value, and often it was a matter of great difficulty to get the wound to heal.

There are two operations, however, that have been attended with a great measure of success in nonfilarial cases, and they probably will be of value in selected filarial cases. One is the

Sampson-Handley (39) operation for the establishing of a new lymphatic circulation; the second is the Kondoléon (17) operation.

The first, so far as I am aware, has proved disappointing in cases of this kind. It consists in the insertion of silk threads leading from the area of lymph stasis into an area above the seat of obstruction. Dr. A. F. Cole, late of Ningpo, performed several of these operations on cases of this class. In the ones that succeeded there was considerable improvement in the size of the limb for the time being, but, so far as I am aware, all relapsed later.

The Kondoléon (17) operation gives more promise of success, but so far few operations of this kind have been performed in China. One has been reported by Bell, (4) who speaks favorably of the result, and several have been performed by Dr. E. J. Strick of Amoy, with good results; but hardly sufficient time has elapsed for one to be able to judge of the final ending of the cases. The principle of the operation is the placing of the deep and the superficial lymphatics in connection by the removal of a large strip of the deep fascia. The fullest and best description of the operation will be found in two papers by Sistrunk, (41) of the Mayo Clinic, Rochester. Some of his results are very good, but they are in nonfilarial cases, and the amount of obstruction at the back of the abdomen must have its influence in determining the final result. At one time it was hoped that the injection of fibrolysin would aid greatly in the treatment of cases of this class; but, so far as I know, it has proved unavailing in producing permanent improvement. The same must also be said of the proposed anastomosis of veins and lymphatics about the saphenous opening.

ELEPHANTIASIS OF THE ARMS

Elephantiasis of the arms is very rare, and I have never seen a case in which I could be quite sure of the diagnosis. I have seen cellulitis of the arm, of filarial origin, but the limb was not a typical case of elephantiasis, and I have not been able to obtain information of a well-marked case in China.

Treatment is unsatisfactory and resolves itself into bandaging, massage, and suitable support. It is possible that the Kondoléon operation might greatly benefit such a case.

ELEPHANTIASIS OF THE MAMMÆ

Elephantiasis of the mammæ also is very rare, and I have never met a case. Probably the smaller incidence of filarial disease among women is the cause. If the growth becomes large, the breast should be amputated. These tumors are occasionally very large and have been known to descend as far as the knees. One on record weighed 21 pounds (9.5 kilograms).(36)

Cases of hypertrophy of the breast may reach a huge size and are found in China, but so far I have seen none to which filarial infection could be assigned as a cause.

ELEPHANTIASIS OF LIMITED SKIN AREAS

Elephantiasis of limited skin areas are also rare, but not so rare as the kind just discussed. I have several times seen flat elephantoid areas on the thighs, but have never seen any sufficiently serious to justify operation.

Localized pedunculated tumors have been reported from other localities. Corney, (11) of Fiji, Daniels, (12) and Silcock (40) have described cases of this kind. Daniels met with his cases in Fiji and Demerara, and Silcock's patient was an East Indian. The tumors are easily removed by operation.

THE EFFECT OF FILARIAL INFECTION ON THE COURSE OF OTHER DISEASES

A few observations have been made on the effect of filarial infection on the course of other diseases. Surgical wounds in the subjects of filarial disease heal very well, unless they happen to be in an elephantoid area and have been allowed to become septic, in which case they heal very badly. One case, a man who had been clawed by a tiger, who came into my hands very badly torn and whose blood was swarming with filaria, healed well. Ordinary operation wounds heal by first intention quite as well as in other subjects. Broken bones also unite without any trouble. Operations for cataract follow a normal course.

Of the medical diseases, malaria and filariasis are not antagonistic, and they have been frequently seen combined in the same subject. Enlarged malarial spleen and elephantiasis not infrequently coexist in a patient.

Typhoid fever is not influenced in its course by filariasis. Three times I have seen them coexist, without the fever being in the least modified.

Lung diseases are unfavorably modified by the presence of filariasis, especially pneumonia. Twice I have seen patients, the subjects of filarial disease, removed in a dying condition by their friends; one case died in the hospital, and two or three have had narrow escapes. One cannot dogmatize on the matter, but probably it will be found that a large number of these filariasis cases die of lung trouble in the end. A fair number suffer from phthisis, but whether the number is greater among them than among the general population, it is impossible to say.

A certain number of such patients suffer from nephritis, but what has just been stated about the proportion of phthisis cases holds for these also.

How is the disease to be dealt with as a whole?

McNaughton (22) has reported a few cases treated by salvarsan, in which it was claimed that the parent worm had been killed by the treatment. I am not aware of any special work that has been done in this direction in China; but, as has been stated previously, the killing of the parent worm, even if it can be certainly done, is not altogether devoid of risk to the host.

The extirpation of the mosquito carrier in southern China is a matter of impossibility, but much might be done by a proper use of the mosquito net or a screening of the bedroom in which the infected person sleeps. But what of the number of patients who are infected and do not know it? The whole problem is one beset with difficulties, and it must be confessed that the mosquito net, with all its drawbacks, is the most practical preventive measure at our command at the present time.

ACKNOWLEDGMENT

I wish to thank many of my fellow workers in southern China for kindly answering queries put to them from time to time, as well as those who have kindly placed photographs at my disposal.

REFERENCES

(1) AZEMA, M. Tropical Diseases. Cassell, London (1917)
(2) BANCROFT, Sr. Discovery of the adult representative [illegible] filarias. Lancet, London 2 (1877) 70, communicated by [illegible]obbold.
(3) BANCROFT, T. L. Journ. Trop. Med. London 2 (1899) 91.
(4) BELL, L. N. Am. Journ. Gyn. & Obstet. 29 (1919) 199.
(5) BRAZILIAN PHYSICIANS. Diseases of Warm Climates. Pentland, London (1893) 781.
(6) CALVERT, W. J. Johns Hopkins Bull. 13 (1902) 133.
(7) CHARLES, R. H. Ind. Med. Gaz. 36 (1901) 133.
(8) IDEM. Ind. Med. Gaz. 36 (1901) 133.
(9) IDEM. Ind. Med. Gaz. 36 (1901) 133.
(10) COLES, A. C. The blood in cases affected with filariaris and bilharzia haematobia. Brit. Med. Journ. 1 (1902) 1137.
(11) CORNEY, B. "Sibi and Ceke." Lancet, London 1 (1889) 679.
(12) DANIELS, C. W. Brit. Guiana Med. Ann. (1896).

(13) Demarquay. Gaz. Med. de Paris 18 (1863) 665.

(14) Dutton, J. E. Brit. Med. Journ. 2 (1901) 612.

(15) Gulland, G. L. The condition of the blood in filariasis. Brit. Med. Journ. 1 (1902) 831.

(16) James, S. P. Ind. Med. Gaz. 36 (1901) 114 (letter).

(17) Kondoléon, E. Centralbl. f. Chir. 39 (1912) 1022.

(18) Leiper, R. T. Thelaziasis in man; a summary of recent reports of "Circumlocular Filariasis" in Chinese literature with a note on the zoölogical position of the parasite. Brit. Journ. Ophthalmology 1 (1917) 546.

(19) Lewis, T. R. 8th, 10th, and 14th Annual Reports of the Sanitary Commissioner with the Government of India.

(20) Low, G. C. A recent observation on Filaria in Culex. Brit. Med. Journ. 1 (1900) 1456.

(21) Maitland. Ind. Med. Gaz. (1898) October.

(22) McNaughton, J. G. Journ. Trop. Med. 19 (1916) 249.

(23) McLeod. Tropical Diseases. Cassell, London (1917) 728.

(24) Manson, P. Trans. Linn. Soc. London 2d ser. Zoölogy 11, part 10, 367.

(25) Idem. Hygiene and Diseases of Warm Climates. Pentland, London (1893) 765.

(26) Idem. Tropical Diseases. Cassell, London (1917) 688.

(27) Idem. Tropical Diseases. Cassell, London (1917) 710.

(28) Idem. Tropical Diseases. Cassell, London (1917) 711.

(29) Idem. Tropical Diseases. Cassell, London (1917) 704.

(30) Idem. Tropical Diseases. Cassell, London (1917) 715.

(31) Idem. Tropical Diseases. Cassell, London (1917) 713.

(32) Idem. Tropical Diseases. Cassell, London (1917) 717.

(33) Idem. Hygiene and Diseases of Warm Climates. Pentland, London (1893) 787.

(34) Idem. Hygiene and Diseases of Warm Climates. Pentland, London (1893) 791.

(35) Idem. Tropical Diseases. Cassell, London (1917) 725.

(36) Idem. Tropical Diseases. Cassell, London (1917) 733.

(37) Matas, R. Am. Journ. Trop. Dis. & Preventive Med. 1 (1913) 60–85.

(38) Moty. Revue de Chirurgie (1892) January.

(39) Sampson-Handley, W. Lymphangioplasty. Lancet, London 1 (1908) 783–785.

(40) Silcock. Ind. Med. Gaz. (1895) July.

(41) Sistrunk, W. E. Surg. Gyn. & Obstetrics 26 (1918) 388–393; Mayo Clinic Papers 10 (1918) 983–996.

(42) Sonsino. Med. Times & Gazette, London (1882).

(43) Stuckey, E. J., and Houghton, H. S. Circumlocular filariasis. China Med. Journ. 31 (1917) 24 and Brit. Journ. Ophthalmology 1 (1917) 542.

(44) Whyte, G. D. Journ. Trop. Med. 12 (1909) 172.

(45) Winkel. Hygiene and Diseases of Warm Climates. Pentland, London (1893) 789.

(46) Wücherer. Gaz. Medica de Bahia (1868) December 5; (1869) September 30.

ILLUSTRATIONS

[Plates 1, 2, and 3 are reprinted from Tropical Diseases by the kind permission of Messrs. Cassell & Company, Limited; Plate 11 is from a photograph by Dr. J. M. Howie; Plate 15, from a photograph by Dr. P. B. Cousland; Plate 16, from a photograph by Dr. J. H. Montgomery; Plate 25, from a photograph by Canton Hospital staff; and Plate 26, from a photograph by Dr. E. J. Strick.]

Plate 1

Anatomy of *Filaria bancrofti* embryo. *a*, sheath; *b*, central viscus; *c*, V spot; *d*, tail spot.

Plate 2

Fig. 1. Section of thoracic muscles of mosquito about twelve days after it had fed on a filariated patient.

2. Filariæ in head or proboscis of mosquito. *a*, filariæ; *b*, labium; *c*, labium; *d*, base of hypopharynx; *e*, duct of veneno-salivary gland; *f*, cephalic ganglia; *g*, eye; *h*, œsophagus; *j*, pharyngeal muscles.

Plate 3

Metamorphosis of filaria in mosquito. *a*, *b*, *c*, *d*, *e*, *f*, progressive forms of the parasite.

Plate 4

Section of a varicose groin gland, showing great dilatation of vessels, both lymphatic and blood vessels, with hyperplasia of the gland tissue; × 60.

Plate 5

Fig. 1. Section of skin just becoming affected with elephantoid changes, showing a tendency to round-cell infiltration, with dilatation of lymph spaces. × 60. The large space is a defect in the section.

2. Section of skin from fully developed elephantiasis scroti, showing dense fibrous felting with thickening of the epithelial layers and corium. × 60.

Plate 6

Early elephantiasis scroti, showing the scar of a filarial abscess of the scrotum on the right side.

Plate 7

Lymph scrotum. In this case the swelling of the groin glands is not marked. There is some œdema of the preputial skin, and the vesicles on the scrotum are well shown.

Plate 8

Lymph scrotum; penis unaffected. Shows well the lax, œdematous look that some of these cases present. The dark patch is due to iodine, which had been painted over large and aching groin glands.

PLATE 9

FIG. 1. Elephantiasis of penis; scrotum unaffected.
2. Cauliflower condition of preputial tissues.

PLATE 10

Elephantiasis of the penis; scrotum slightly affected.

PLATE 11

Elephantiasis scroti (narrow-necked), weighing, after removal, 32 kilograms. Patient an opium smoker. The slit in the center represents the urinary orifice, the glans being just beyond the reach of my finger when inserted at the opening.

PLATE 12

Condition of parts three weeks after operation. The testicles being atrophied, and the patient in a weak condition at the time of operation, these were removed, thus facilitating healing.

PLATE 13

Elephantiasis scroti. The warty condition of the penis is well shown. The skin of the abdomen was slightly affected as far up as the umbilicus. Weighed, after removal, 16.3 kilograms. It will be evident how impossible it is properly to disinfect the skin in a case of this kind.

PLATE 14

Elephantiasis scroti, showing a twisted condition, not infrequently seen, affecting the penile tissues. Weight after removal, 3.2 kilograms.

PLATE 15

FIG. 1. Elephantiasis scroti, broad-necked.
2. Elephantiasis of the cheeks.

PLATE 16

Condition of parts thirteen days after operation. Shows well the preputial lining turned back to form part of the coating of the penis. This patient has had two children since operation.

PLATE 17

Œdema of the penis, which came on shortly after the operation. This was due almost certainly to the contraction of the healing wound. It passed away of itself within a year, and the patient recovered completely. In the right groin the scar of the hernia incision is visible.

PLATE 18

Elephantiasis scroti. Leg also affected.

PLATE 19

Elephantiasis of both legs, the left also showing the troublesome chronic ulceration met with in some of these affected legs. The fold at the ankle and the shapeless condition of the foot are well shown.

PLATE 20

Elephantiasis of leg, due to plague.

PLATE 21

Elephantiasis of leg, due to tertiary syphilis.

PLATE 22

FIG. 1. Elephantiasis of one leg.
2. Elephantiasis vulvæ, sessile form.

PLATE 23

Elephantiasis vulvæ, pedunculated.

PLATE 24

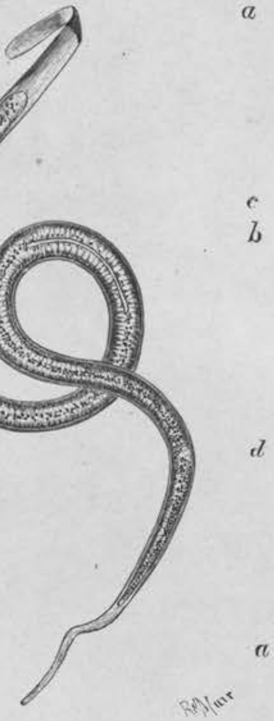
Elephantiasis vulvæ, pedunculated.

PLATE 25

Map of China, showing the distribution of filarial disease.

TEXT FIGURES

FIG. 1. Chart of elephantoid fever.
2. Typical chart; filarial abscess.
3. Chart of filarial abscess.
4. Chart of neglected case of filarial abscess.



a, sheath; b, central viscus; c, V spot; d, tail spot.

PLATE 1. ANATOMY OF FILARIA BANCROFTI EMBRYO.

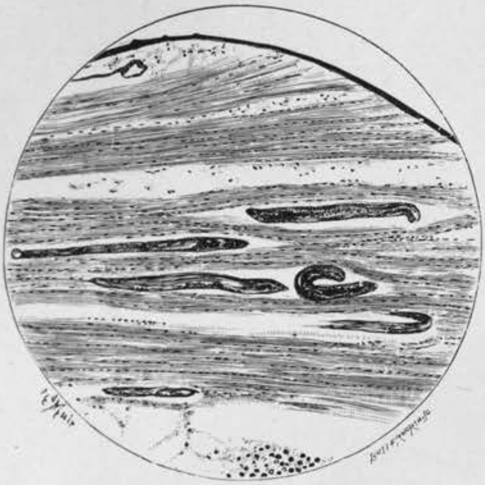


Fig. 1. Filariæ in thoracic muscles of mosquito.

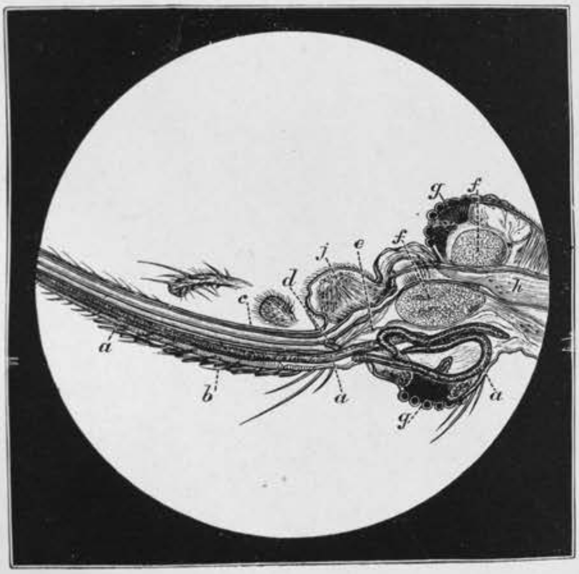
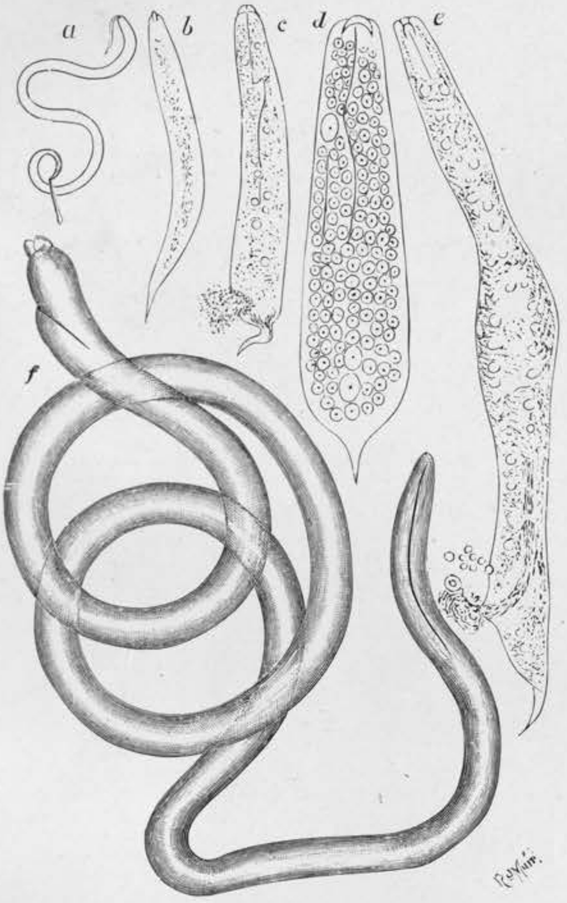


Fig. 2. Filariæ in head or proboscis of mosquito.

PLATE 2.



a, b, c, d, e, f, progressive forms of the parasite.

PLATE 3. METAMORPHOSIS OF FILARIA IN MOSQUITO.

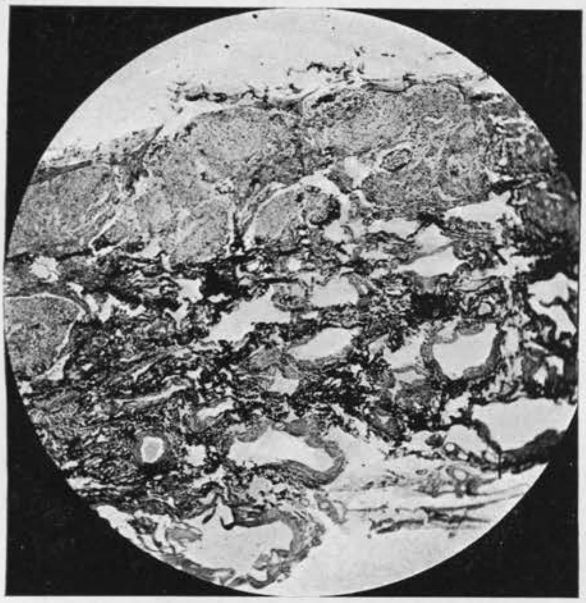


PLATE 4. SECTION OF A VARICOSE GROIN GLAND, SHOWING GREAT DILATATION OF VESSELS, BOTH LYMPHATIC AND BLOOD VESSELS, WITH HYPERPLASIA OF THE GLAND TISSUE; × 60.

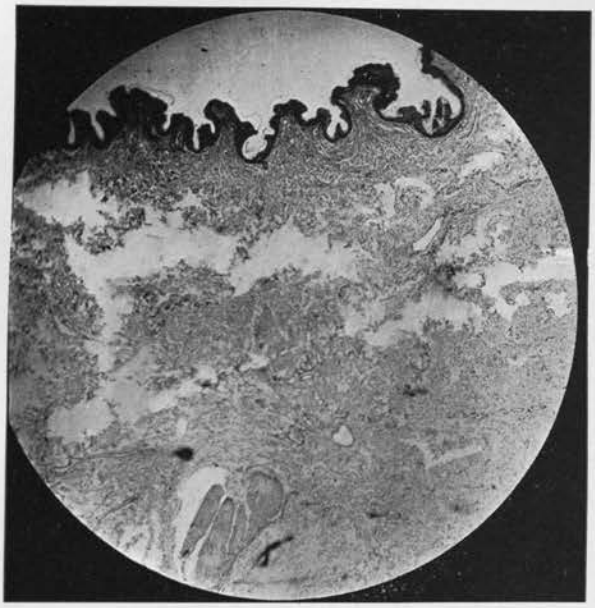


Fig. 1. Section showing early elephantoid changes in skin.

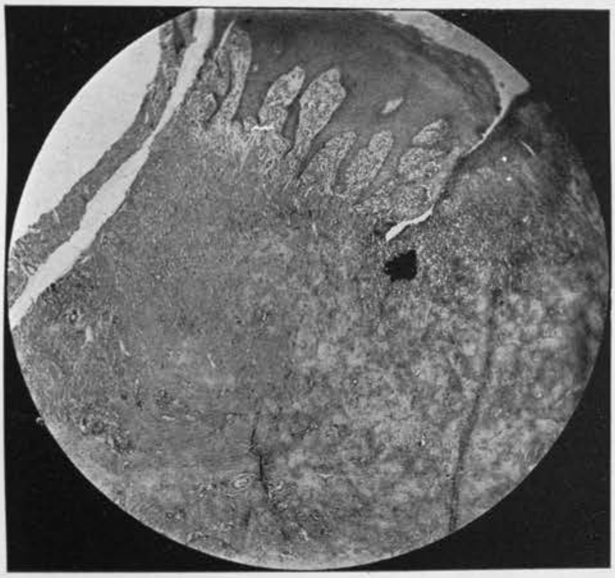


Fig. 2. Section of skin from case of fully developed elephantiasis.

PLATE 5.

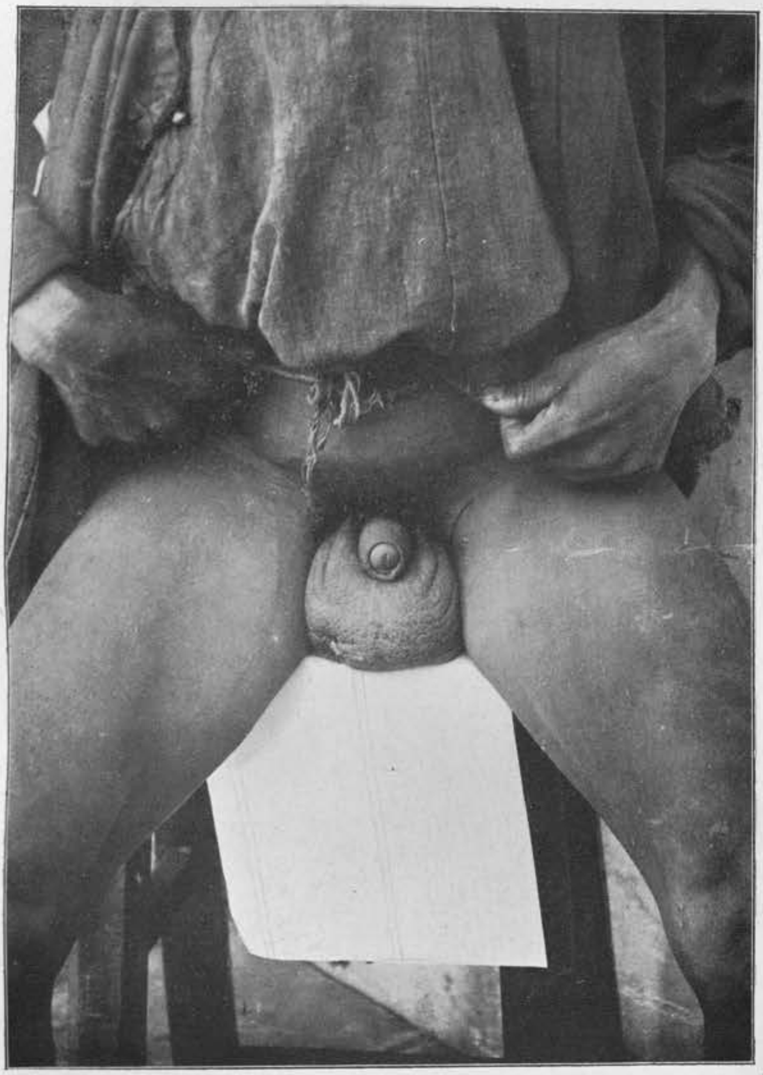


PLATE 6. EARLY ELEPHANTIASIS SCROTI, SHOWING THE SCAR OF A FILARIAL ABSCESS OF THE SCROTUM ON THE RIGHT SIDE.

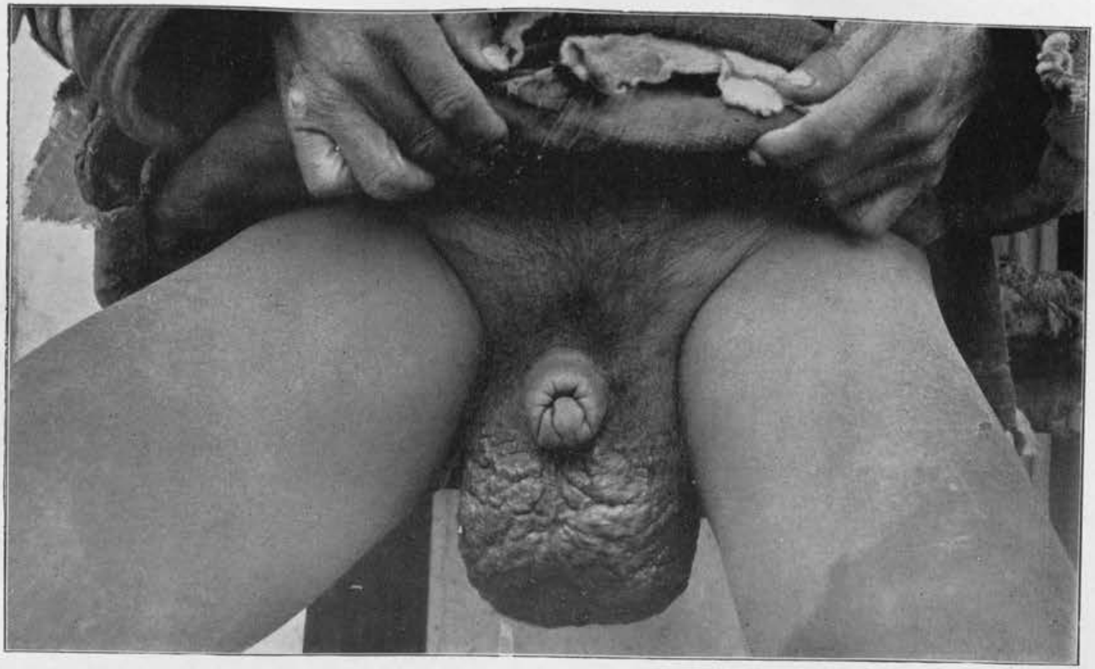


PLATE 7. LYMPH SCROTUM. IN THIS CASE THE SWELLING OF THE GROIN GLANDS IS NOT MARKED. THERE IS SOME ŒDEMA OF THE PREPUTIAL SKIN, AND THE VESICLES ON THE SCROTUM ARE WELL SHOWN.

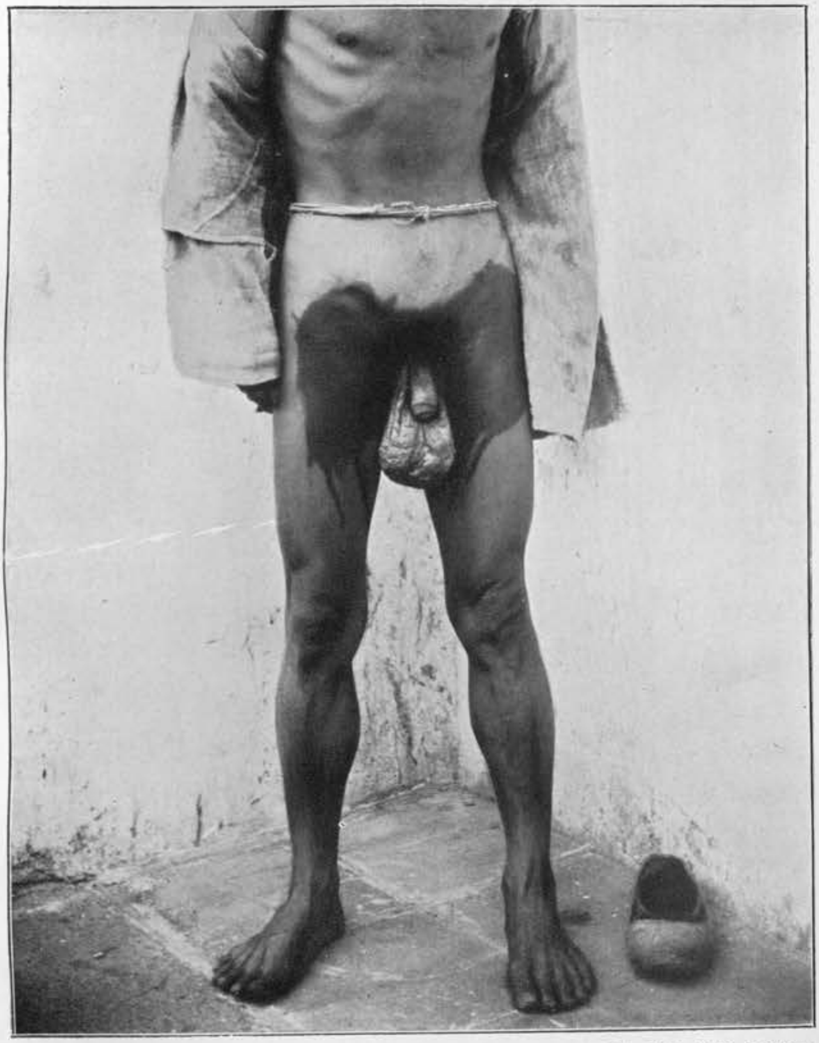


PLATE 8. LYMPH SCROTUM; PENIS UNAFFECTED. SHOWS WELL THE LAX, ŒDEMATOUS LOOK THAT SOME OF THESE CASES PRESENT. THE DARK PATCH IS DUE TO IODINE, WHICH HAD BEEN PAINTED OVER LARGE AND ACHING GROIN GLANDS.

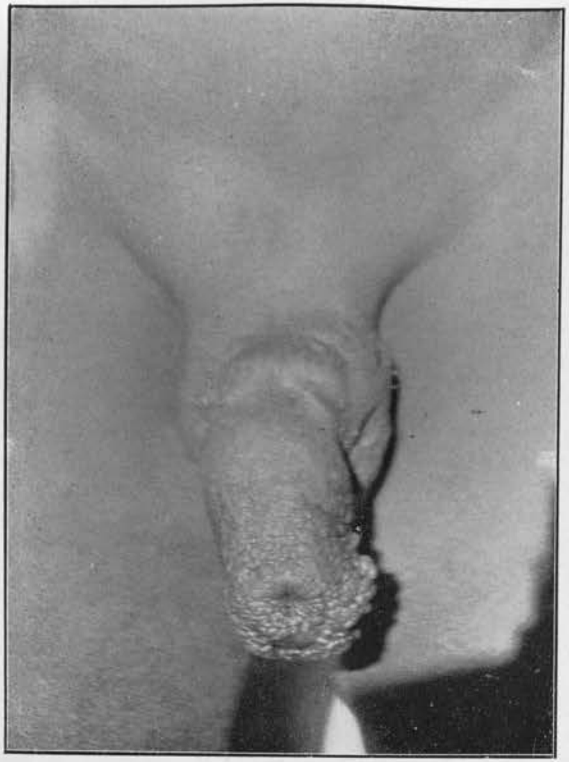


Fig. 1. Elephantiasis of the penis; scrotum unaffected.

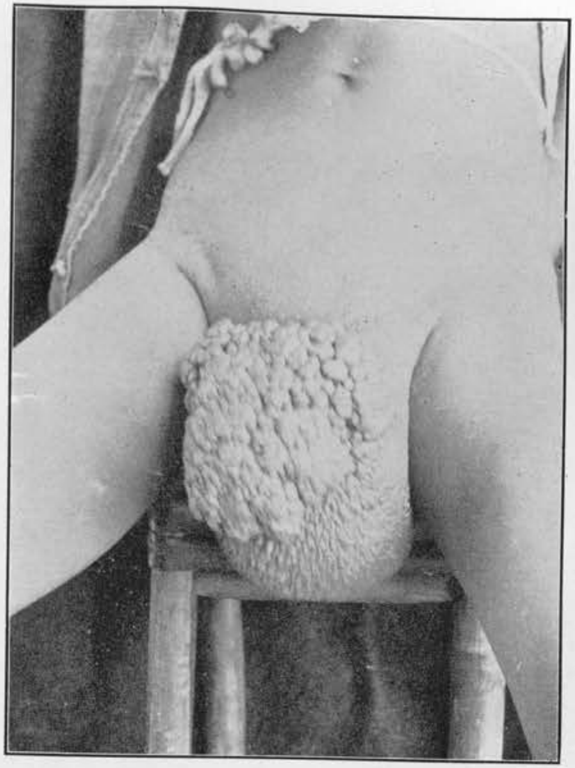


Fig. 2. Cauliflower condition of preputial tissues.

PLATE 9.

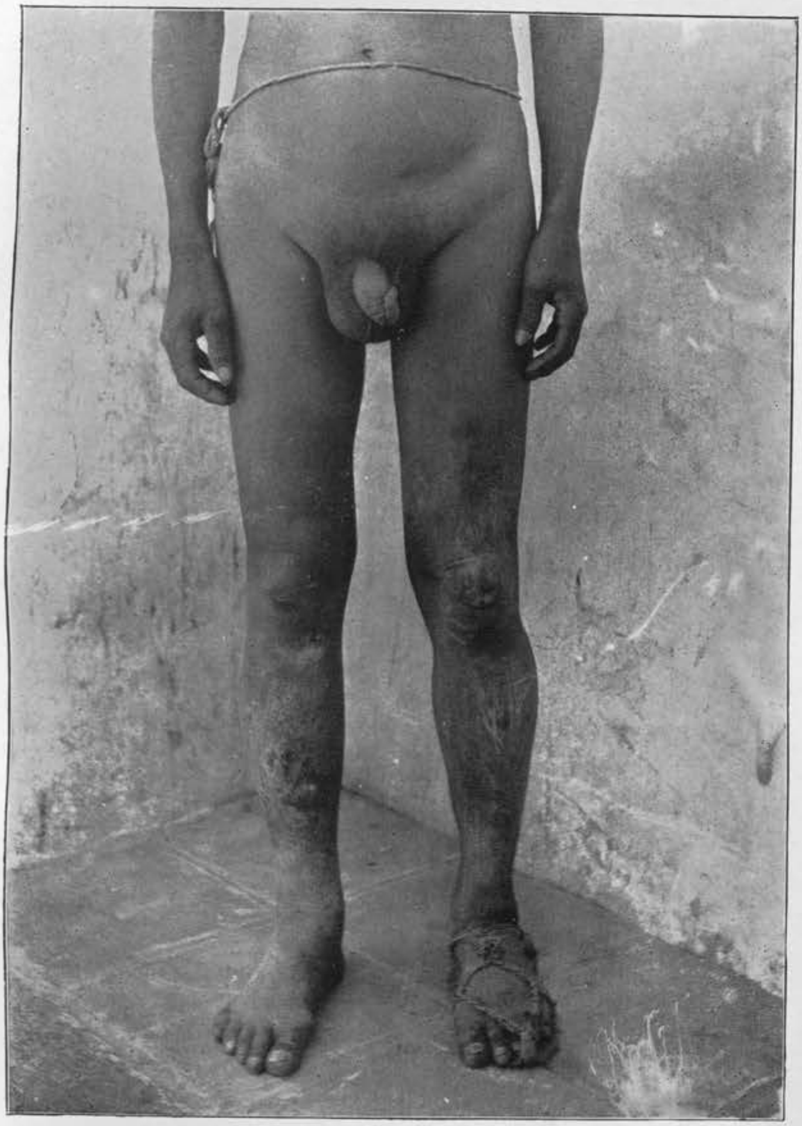


PLATE 10. ELEPHANTIASIS OF THE PENIS; SCROTUM SLIGHTLY AFFECTED.

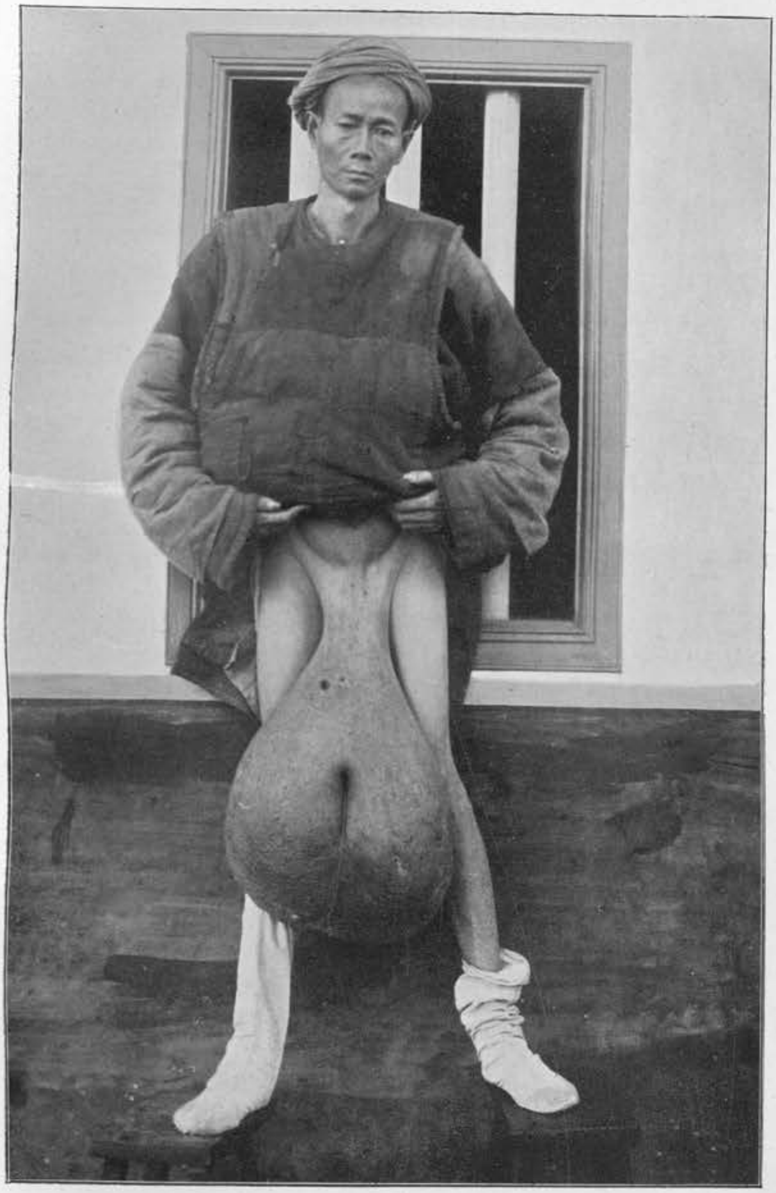


PLATE 11. ELEPHANTIASIS SCROTI (NARROW NECKED), WEIGHING, AFTER REMOVAL, 32 KILOGRAMS. PATIENT AN OPIUM SMOKER. THE SLIT IN THE CENTER REPRESENTS THE URINARY ORIFICE, THE GLANS BEING JUST BEYOND THE REACH OF MY FINGER WHEN INSERTED AT THE OPENING.

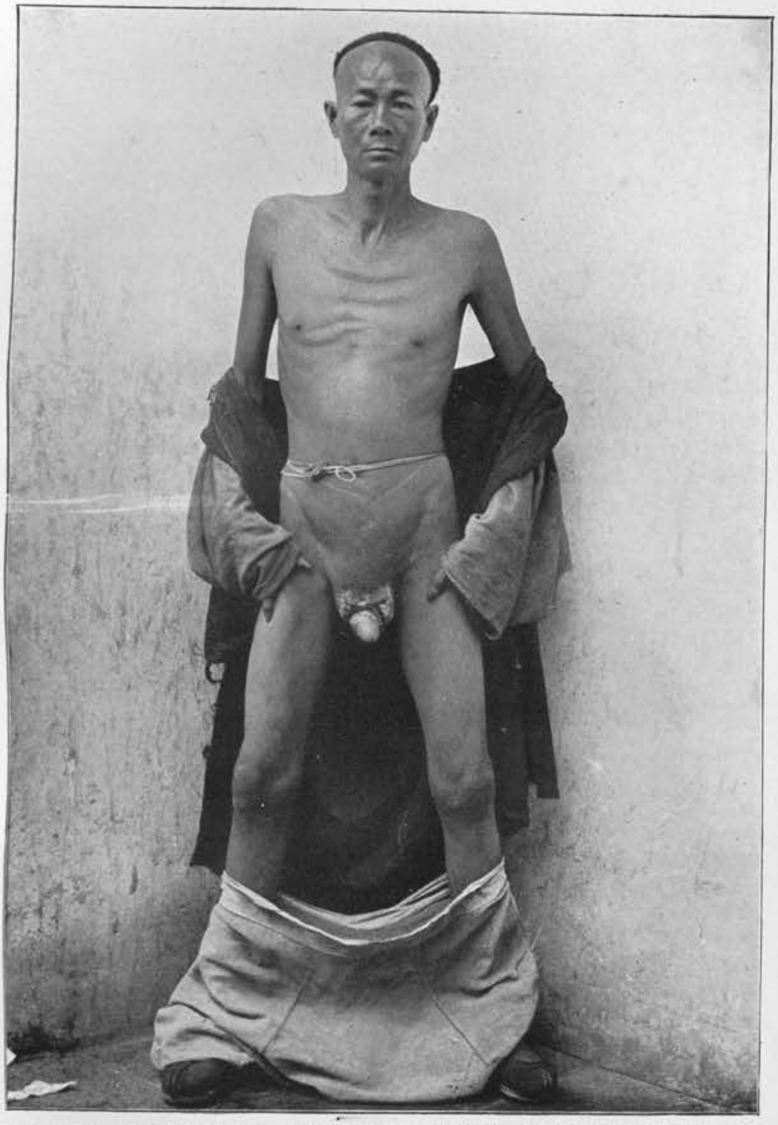


PLATE 12. CONDITION OF PARTS THREE WEEKS AFTER OPERATION. THE TESTICLES BEING ATROPHIED, AND THE PATIENT IN A WEAK CONDITION AT THE TIME OF OPERATION, THESE WERE REMOVED, THUS FACILITATING HEALING.

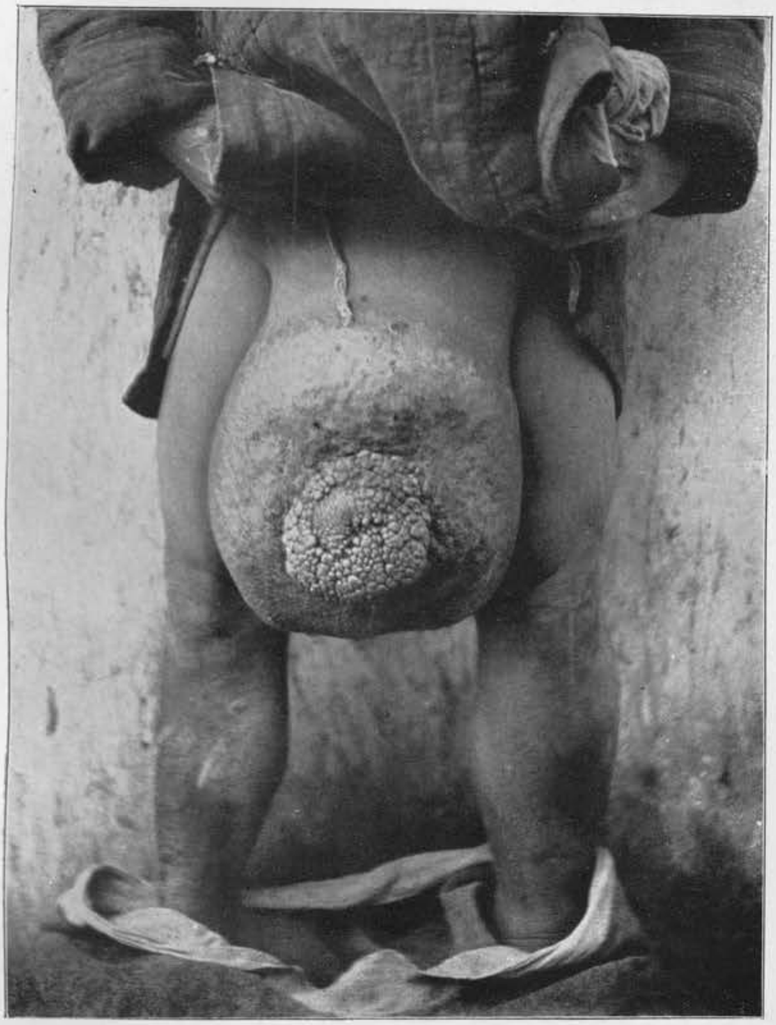


PLATE 13. ELEPHANTIASIS SCROTI. THE WARTY CONDITION OF THE PENIS IS WELL SHOWN. THE SKIN OF THE ABDOMEN WAS SLIGHTLY AFFECTED AS FAR AS THE UMBILICUS. WEIGHT, AFTER REMOVAL, 16.3 KILOGRAMS.

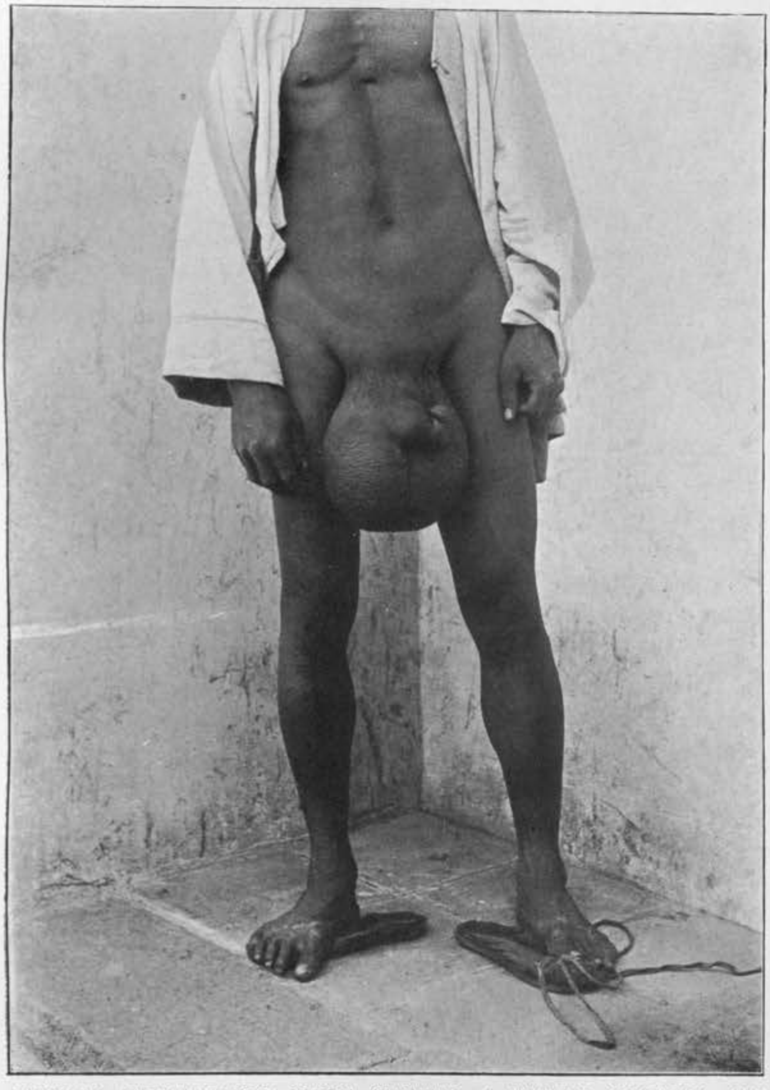


PLATE 14. ELEPHANTIASIS SCROTI, SHOWING A TWISTED CONDITION, NOT INFREQUENTLY SEEN, AFFECTING THE PENILE TISSUES. WEIGHT AFTER REMOVAL, 3.2 KILOGRAMS.

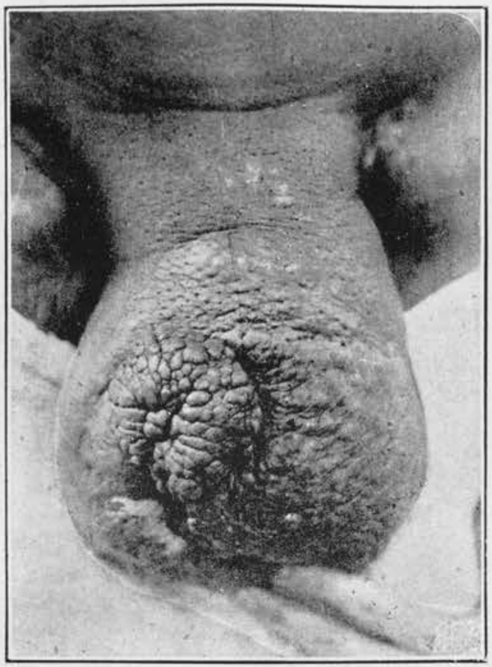


Fig. 1. Elephantiasis scroti, broad-necked.

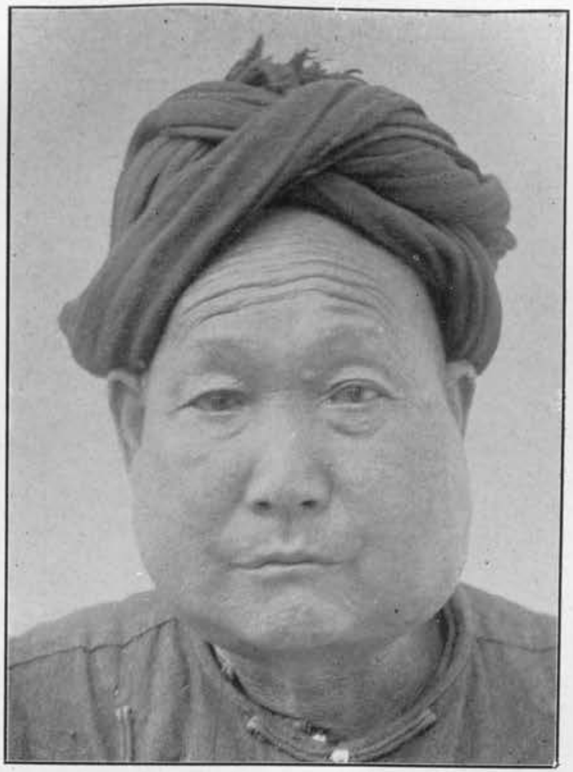


Fig. 2. Elephantiasis of the cheeks.

PLATE 15

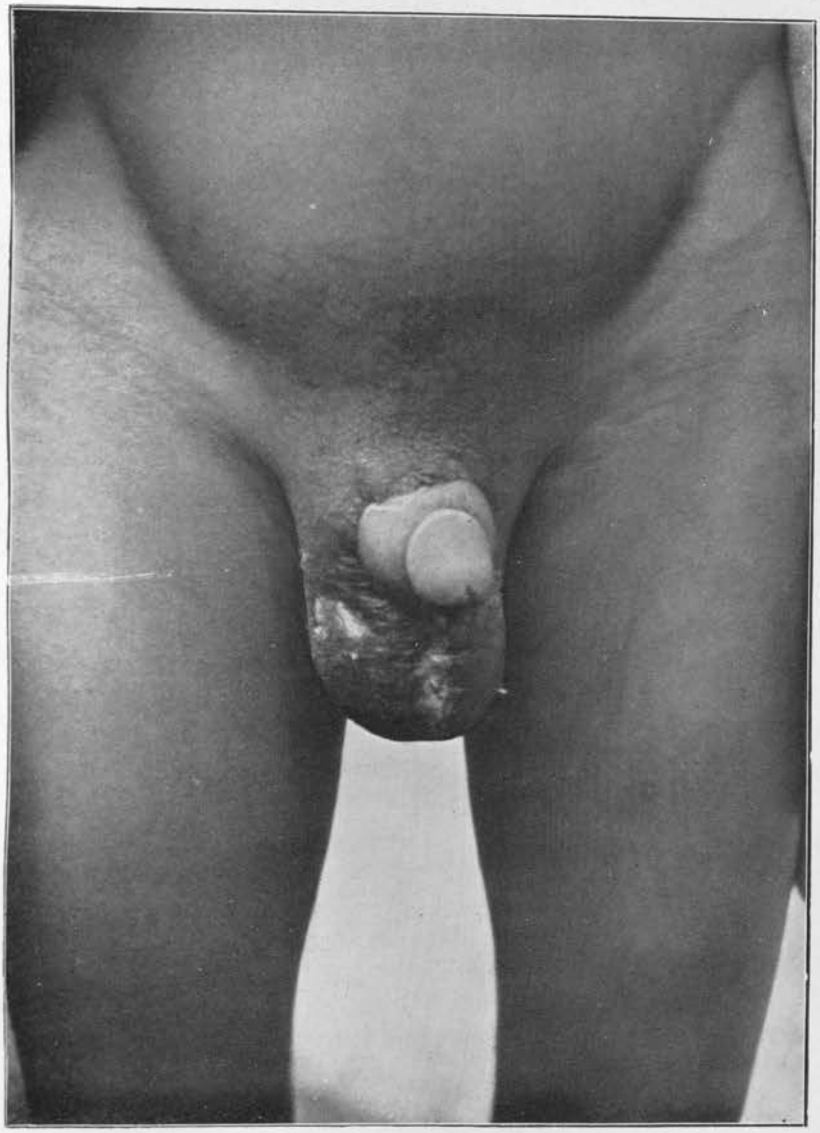


PLATE 16. CONDITION OF PARTS THIRTEEN DAYS AFTER OPERATION. SHOWS WELL THE PREPUTIAL LINING TURNED BACK TO FORM PART OF THE COATING OF THE PENIS.

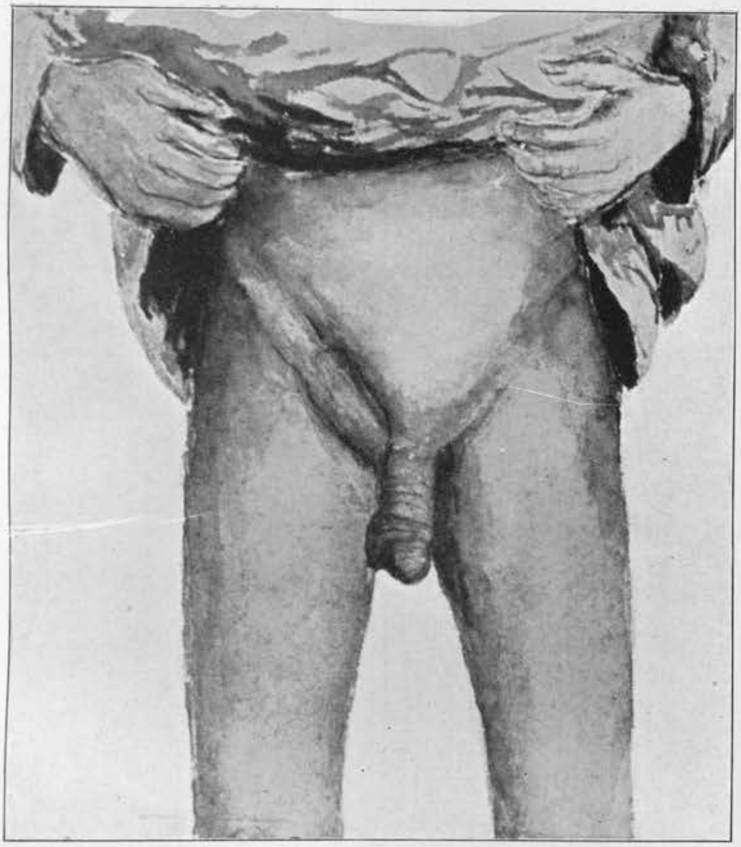


PLATE 17. ŒDEMA OF THE PENIS, WHICH CAME ON SHORTLY AFTER THE OPERATION. THIS WAS DUE ALMOST CERTAINLY TO THE CONTRACTION OF THE HEALING WOUND. IT PASSED AWAY OF ITSELF WITHIN A YEAR, AND THE PATIENT RECOVERED COMPLETELY. IN THE RIGHT GROIN THE SCAR OF THE HERNIA INCISION IS VISIBLE.

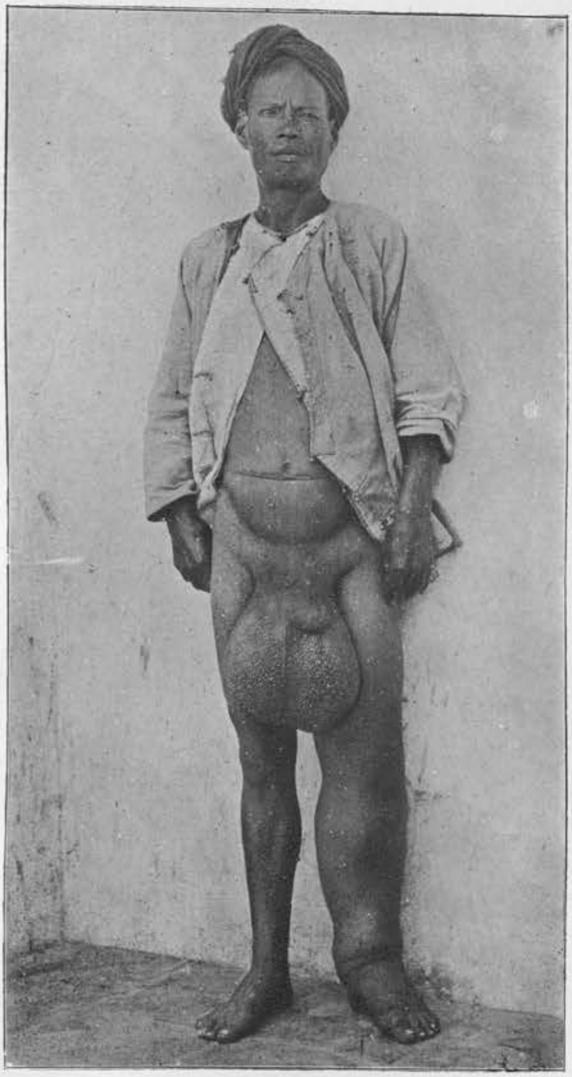


PLATE 18. ELEPHANTIASIS SCROTI. LEG ALSO AFFECTED.

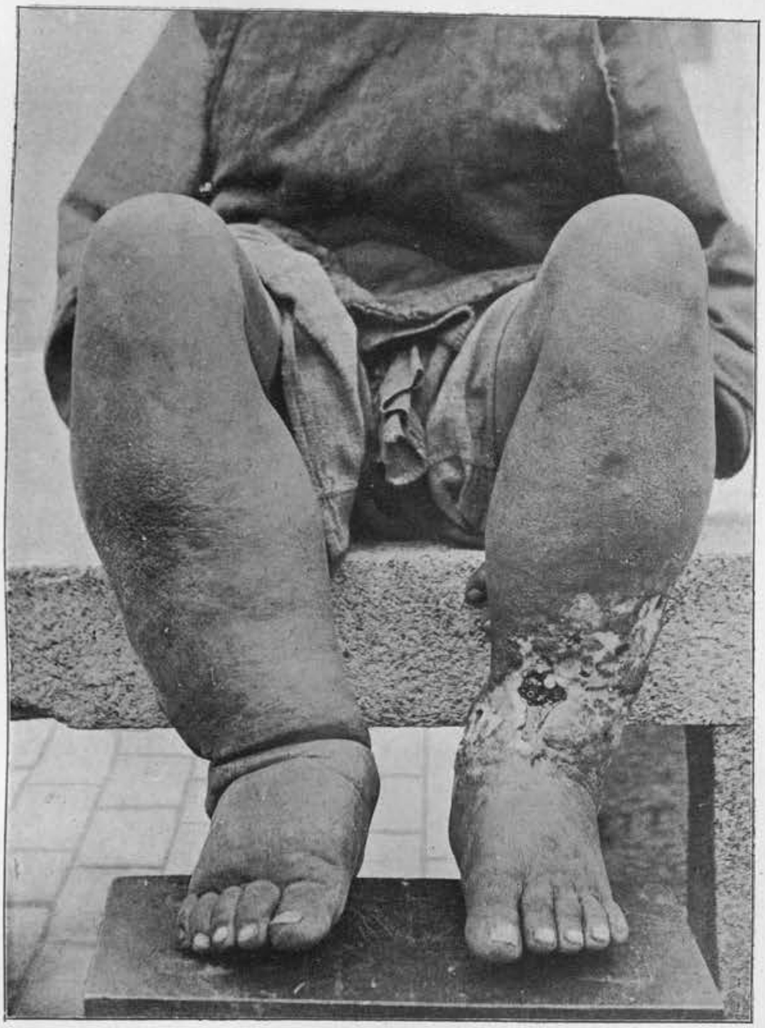


PLATE 19. ELEPHANTIASIS OF BOTH LEGS, THE LEFT ALSO SHOWING THE TROUBLESOME CHRONIC ULCERATION MET WITH IN SOME OF THESE AFFECTED LEGS. THE FOLD AT THE ANKLE AND THE SHAPELESS CONDITION OF THE FOOT ARE WELL SHOWN.

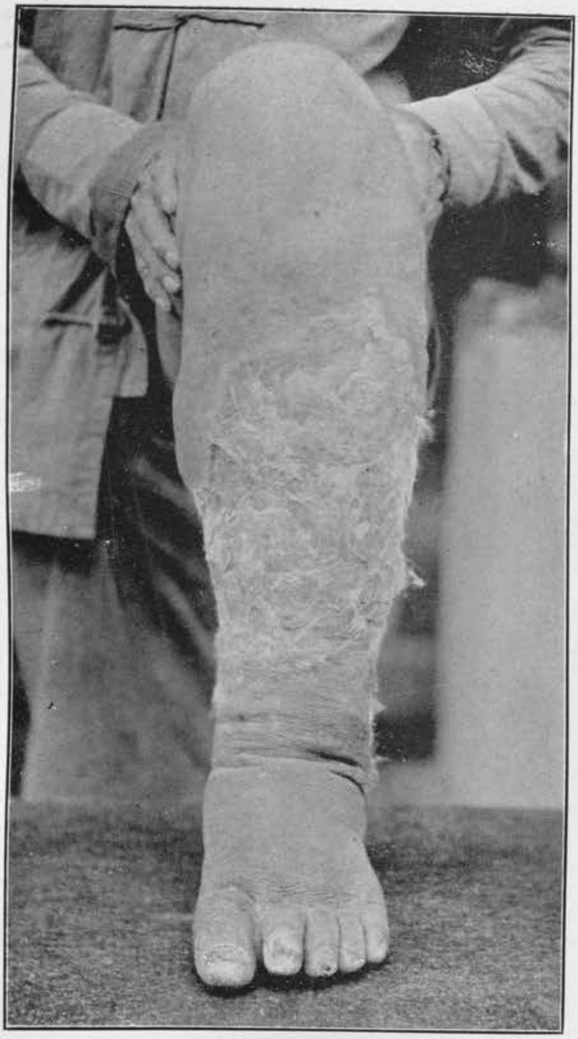


PLATE 20. ELEPHANTIASIS OF LEG, DUE TO PLAGUE.

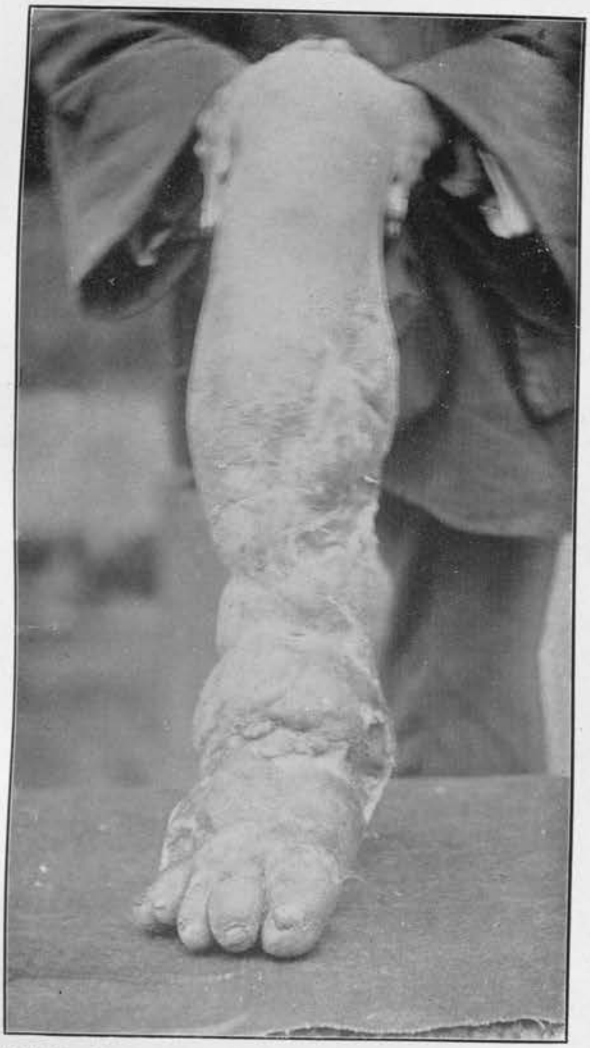


PLATE 21. ELEPHANTIASIS OF LEG, DUE TO TERTIARY SYPHILIS.

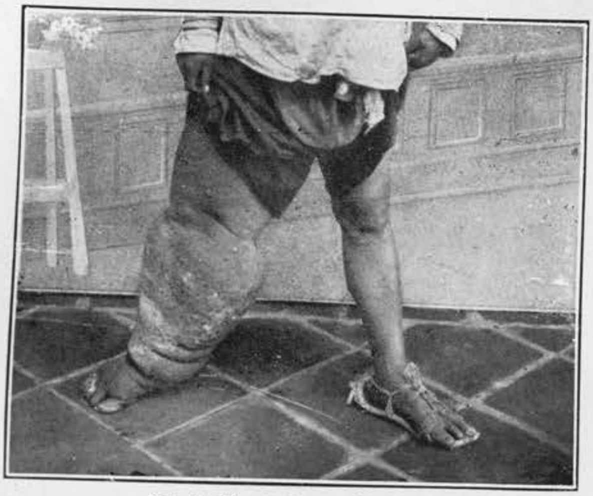


Fig. 1. Elephantiasis of one leg

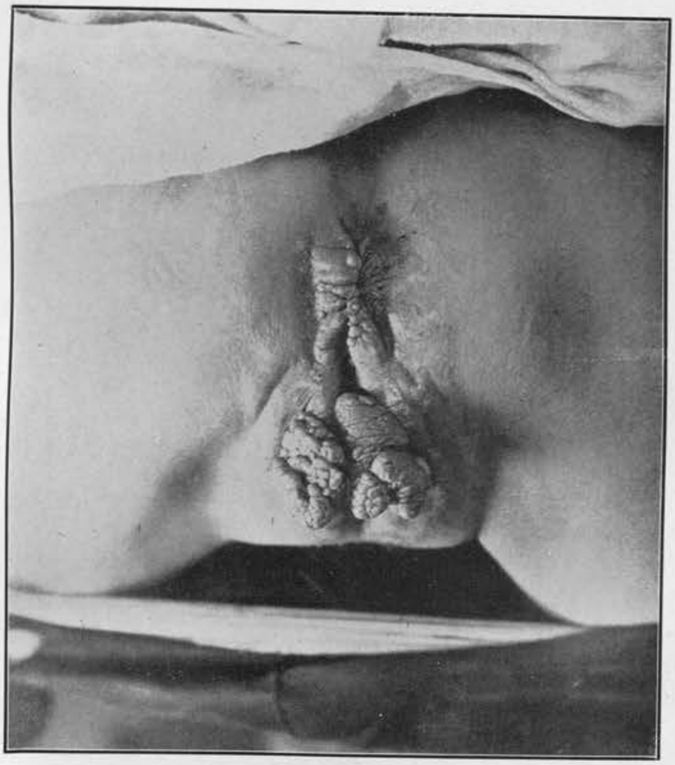


Fig. 2. Elephantiasis vulvæ, sessile form.

PLATE 22.

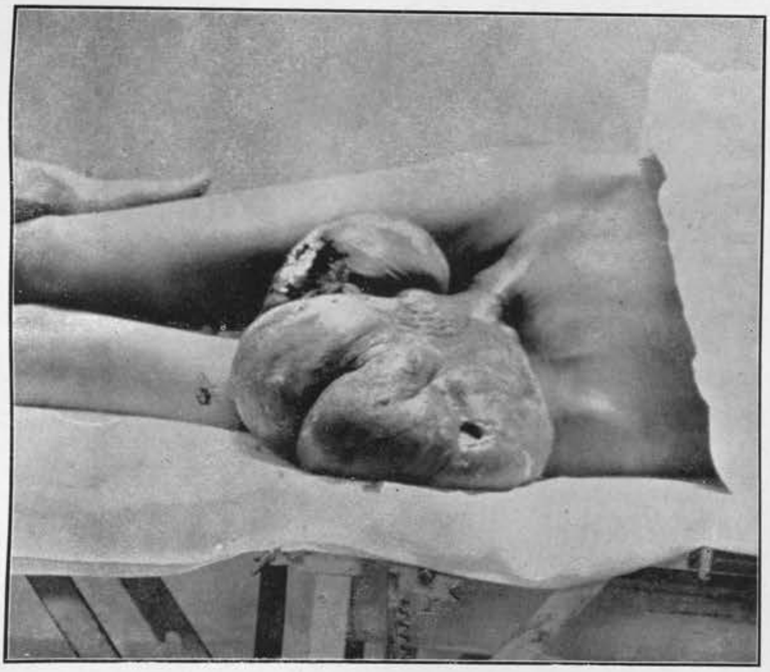


PLATE 23. ELEPHANTIASIS VULVÆ, PEDUNCULATED.

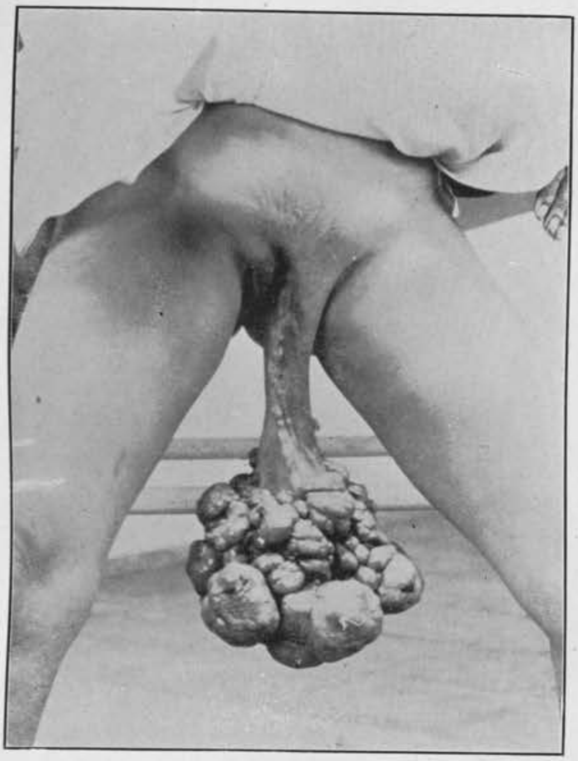


PLATE 24. ELEPHANTIASIS VULVÆ. PEDUNCULATED.

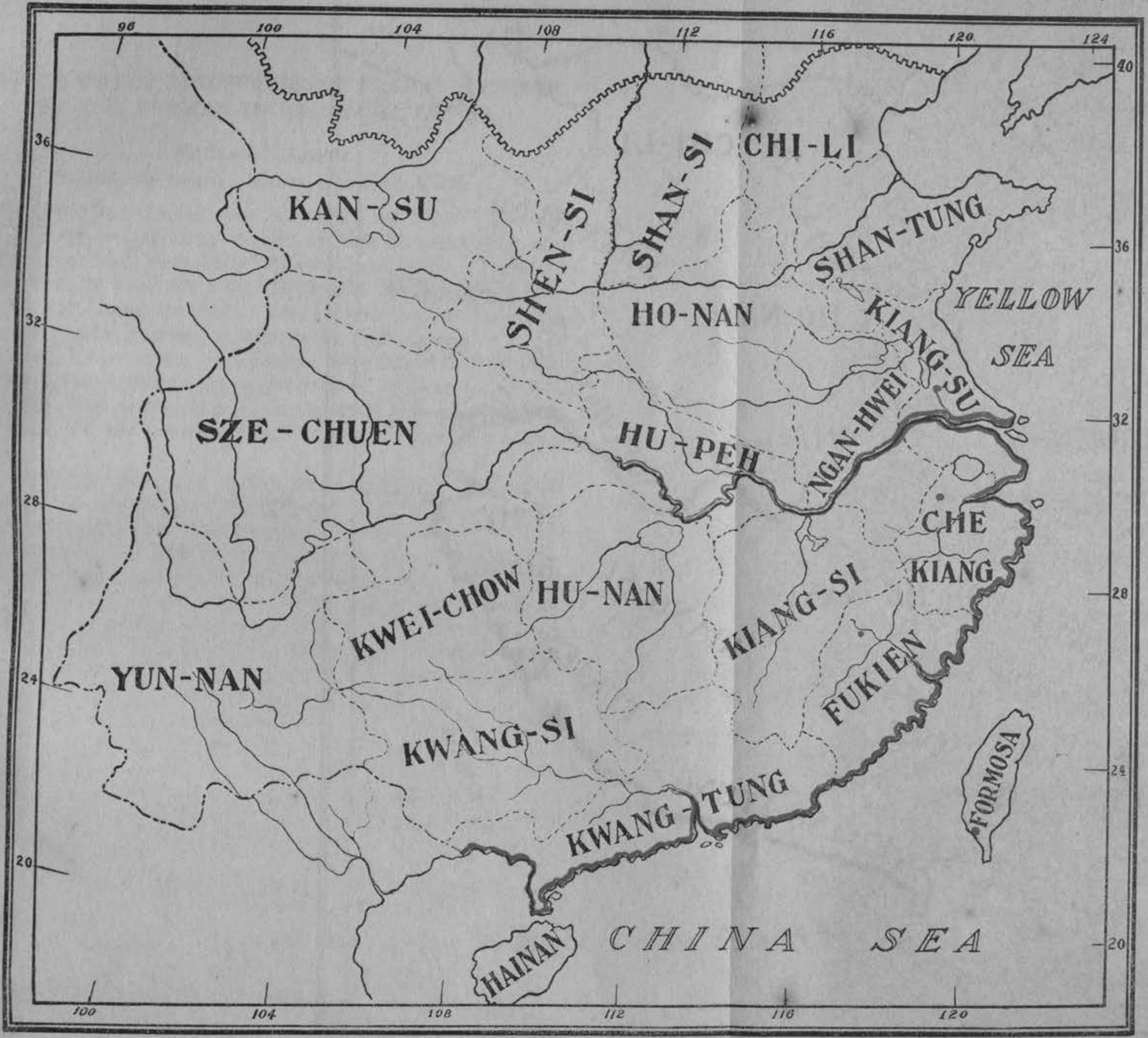


PLATE 25. CHINA, SHOWING THE DISTRIBUTION OF FILARIAL DISEASE.

A REVIEW OF THE NEW SPECIES OF PLANTS PROPOSED BY N. L. BURMAN IN HIS FLORA INDICA

By ELMER D. MERRILL

Director and Botanist, Bureau of Science, Manila

Burman's Flora Indica was published in 1768.[1] The appended "Series zoophytorum Indiae Orientalis" occupies 2, and the "Flora Capensis Prodromus" 28 additional pages. The work is illustrated by 67 plates with 179 figures, the illustrations for the most part being excellent. The present review deals only with those species proposed as new in the Flora Indica.

Burman's Flora Indica is of distinct importance from a historical standpoint owing to its early date of publication, as it is one of the first works other than those of Linnaeus himself, published under the Linnean system of classification and nomenclature.

It is apparent that most of the species proposed by Burman were based on actual specimens, although some of the binomials are manifestly based on descriptions and figures in various pre-Linnean works. In most cases where new binomials are proposed by Burman, the figures, the descriptive data from actual specimens, or the actual citations of specimens clearly indicate that Burman had specimens even when, as is frequently the case, he adds in his synonymy references to pre-Linnean works. It is hardly necessary to note that, as with Linnaeus, the pre-Linnean references are not always correctly placed.

Burman was in close correspondence with Linnaeus, having visited Upsala in 1760, as noted by Jackson,[2] bringing with him his father's large collection of Cape plants, and was afterwards a frequent correspondent.[3] Burman himself notes in the introduction to his Flora Indica that Linnaeus communicated to him his observations regarding various species. Duplicate specimens transmitted to Linnaeus by Burman were often described by Linnaeus, either under the same binomial Burman used or under another name, some in Mantissa Plantarum 1 (1767), one year earlier than Burman's publication, others in Mantissa Plantarum 2 (1771), three years after Burman's work was published. Of the 241 binomials proposed by Burman in his Flora Indica, about 20 were also published by Linnaeus, as indicated above, while in the case of about 25 others Linnaeus published the same species under binomials other than those used by Burman, but manifestly based on material received from him.

---

[1] Burman, N. L. Flora Indica. | cui accedit | series zoophytorum indicorum, | nec non | Prodromus | Florae Capensis. | IV + 1–242, t. 1–67, + indices 1–15, 1768.

[2] Jackson, B. D., Index to the Linnean Herbarium, Proc. Linn. Soc. (1912) Suppl. 22.

[3] Jackson, B. D., op. cit. 11.

The Flora Indica consists of brief descriptions of about 1,305 species of which about 241 are proposed as new. Burman's work was apparently intended as a descriptive one, covering the species from "the Indies" represented in the material secured by his father, being for the most part based on collections of Piso, Hermann, Garcin, Breyn, Oldenland, Harthog, Kleinhof, Outgaerden, and Pryon. The term India is used in a very broad sense, covering the Tropics of both hemispheres, although the bulk of the material on which the work was based was from the Old World. Of the species included more than 500 are definitely indicated as from India; that is, mostly from what is now known as India proper, although Burman frequently included Javan material under the designation "India." In some cases more definite localities are given, about 20 being indicated as from Coromandel, 25 from Malabar, and a few from other localities in India such as Surat and Bengal. Very many of the species are indicated as occurring in the Tropics of both hemispheres. This distribution in many cases is based perhaps not so much on actual specimens examined from the Tropics of both hemispheres as on material from the Old World, the pantropic distribution being based on pre-Linnean synonyms cited as representing the species; in many cases these pre-Linnean references manifestly are erroneously placed. From Java about 115 species are enumerated; from Ceylon about 90; from China about 50; from Japan about 15; from Persia about 20. There are a few references to Brazilian plants, and fairly numerous ones to those of Amboina and the Moluccas, the latter being largely under those binomials primarily based on references to Rumphius's Herbarium Amboinense. Other species are enumerated from Jamaica, from Virginia, from Egypt, from Arabia, from Peru, from Canada, from Malacca, from Mexico, and a few even from the Cape of Good Hope.

While in most cases the geographic origin of the various specimens cited is correct, some errors have been detected. Thus *Polypodium spinulosum* Burm. f., indicated as originating in Java, is the Australian proteaceous *Synaphea polymorpha* R. Br. = *S. spinulosa* (Burm. f.) Merr.; *Adianthum truncatum* Burm. f., indicated as originating in Java, is the Australian *Acacia decipiens* R. Br.; and the type of *Lotus persicus* Burm. f. was apparently from South Africa rather than from Persia.

Burman proposed but five new generic names, of which three are universally recognized as valid, and two have been reduced as synonyms. These names are as follows: *Clausena*,[4] *Embelia*, *Porania*, *Usubis* (=*Allophylus*), and *Zaleya* (=*Trianthema*).

With the exception of those binomials proposed as new, totaling about 241, all the others in the work are accredited to Linnaeus. In a considerable number of cases it is perfectly evident that Burman erred in his interpretation of Linnean species, and some of his misinterpreted binomials have by later authors been made the basis of new names. Thus *Panicum repens* (non Linn.) Burm. f. Fl. Ind. (1768) 26, *t. 11, f. 1,* although a *Panicum*, scarcely represents the Linnean species; *Poa malabarica* (non Linn.) Burm. f. op. cit. 27, *t. 11, f. 2,* is *Centotheca latifolia* (Osb.) Trin., the Linnean species being *Panicum malabaricum* (Linn.) Merr. (*P. arnottianum* Nees); *Pavetta indica* (non Linn.) Burm. f. op. cit. 35, *t. 13, f. 3,* seems to be an *Ixora;* and *Vitex pinnata* (non Linn.) Burm. f. op. cit. 138, *t. 43* [f. 2] is *Aglaia odorata* Lour., the Linnean species being apparently identical with *Vitex altissima* Linn. f.[5] These are but a few cases that have been noted by me in which Burman's binomial represents other than the species Linnaeus intended; there are unquestionably numerous other similar ones.

The younger Burman's collections, on which the Flora Indica was based, are preserved in the Delessert herbarium, now at the Botanic Garden, Geneva, Switzerland,[6] some specimens from him being also preserved in the Munich herbarium. The actual types, in many cases, have been examined by subsequent authors who were engaged in monographic work; and wherever more amplified descriptions have been published, or reductions made from an examination of Burman's actual types, this has been indicated in the present paper. No botanist with a wide knowledge of the Indo-Malayan flora seems to have made a critical examination of Burman's Flora Indica or of his herbarium with a view of correlating his work with that of other authors. It would admittedly have been best could the extant specimens have been examined; but it being impracticable for me to do this at the present time, I have attempted a preliminary interpretation of Burman's species from the published data alone. Considering the usually short and imperfect descriptions a surprisingly high percentage of Burman's species can definitely be correlated with those of other authors without the necessity of examining his types; but in some cases, indicated by an asterisk in the following enumeration, more definite interpretations than those here indicated cannot be made without an examination of the actual type in each case.

---

[4] In the text this appears as *Claucena*, a manifest typographical error for *Clausena* as printed in the index to Burman's work. According to Wittstein the name is derived from P. Clausön, a Danish author of a work on algae published in 1632.

[5] See Trimen Fl. Ceyl. 3 (1895) 358.

[6] De Candolle, A., La Phytographie (1880) 401.

In completing this short work I am impressed with the fact that many European botanists do not seem fully to realize the value and utility of types when interpreting insufficiently described species of the early authors. In many cases a few hours' journey, or in others merely a little correspondence would make available the data which would definitely fix the status of a species. Instead of this course, however, the unsatisfactory but easy method seems to have been pursued of leaving the unknown ones under "species incognitae," "species valde dubiae," "species excludendae," or other equally unsatisfactory categories.

In order to make the present publication more generally useful to modern botanists I have not treated Burman's species in the sequence in which they were published under the Linnean system of classes and orders, but have rearranged them under the modern system of families and genera, following the Engler and Prantl system.

THALLOPHYTA

ALGAE

CHARALES

CHARA Linnaeus

* **CHARA** sp.[7]

? *Ulva javanica* Burm. f. Fl. Ind. (1768) 239.

This was based on a Javan specimen with a citation of the

---

[7] Species marked with an asterisk in this enumeration are of more or less doubtful status.

Javanese names *rompot scriboe ajer* and *sajor codock.* The reference to *Tremella marina* Dill. Musc. 46, *t. 10, f. 8,* cannot be interpreted as the type as Burman states that his specimens differed from this figure in rather numerous and apparently essential characters. Burman's species is probably a *Chara.*

LICHENES

USNEA Linnaeus

*** USNEA** sp.

Lichen capillaris Burm. f. Fl. Ind. (1768) 239. "Habitat in Amboina & Java."

The type is Kleinhof's Javan specimen, which perhaps represents the same form as that figured by Rumphius as *Muscus capillaris* Rumph. Herb. Amb. 6: 86, *t. 40, f. 2.* It is clearly a species of *Usnea.*

PTERIDOPHYTA

POLYPODIACEAE

NEPHROLEPIS Schott

NEPHROLEPIS RADICANS (Burm. f.) Kuhn in Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 285.

Polypodium radicans Burm. f. Fl. Ind. (1768) 233, *t. 66, f. 3.*

A well-known species of wide distribution in the Indo-Malayan region.

DAVALLIA Smith

DAVALLIA DENTICULATA (Burm. f.) Mett. ex Kuhn Fil. Deck. (1867) 27.

Adiantum (Adianthum) denticulatum Burm. f. Fl. Ind. (1768) 236.

The actual type is a Javan specimen collected by Pryon. Burman notes that this specimen differed somewhat from Plukenet Phyt. 151, *t. 180, f. 4,* which he cites as representing the same species.

ODONTOSORIA Fée

ODONTOSORIA CHINENSIS (Linn.) J. Sm. Bot. Voy. Herald (1857) 430.

Trichomanes chinensis Linn. Sp. Pl. (1753) 1096.

Adiantum (Adianthum) chinense Burm. f. Fl. Ind. (1768) 236.

The actual type was a Chinese specimen, and the description, while short, seems to apply to the very common *Odontosoria chinensis* (Linn.) J. Sm. Burman adds a reference to Plukenet Phyt. 10, *t. 4, f. 1,* and to Ray Hist. 1854.

BLECHNUM Linnaeus

BLECHNUM INDICUM Burm. f. Fl. Ind. (1768) 231. "Habitat in Java."

This is almost certainly identical with *Blechnum serrulatum* Rich. Act. Soc. Hist. Nat. Paris 1 (1792) 114, and if this proves to be the case Burman's name should be adopted for this pantropic species. It is the only Malayan species of the genus to which Burman's description applies.

BLECHNUM ORIENTALE Linn. Sp. Pl. (1753) 1077.

Polypodium simplex Burm. f. Fl. Ind. (1768) 235. "Habitat in Amboina."

Burman apparently had a Javan specimen collected by Kleinhof. *Lonchitis amboinica rubra* Rumph. Herb. Amb. **6**: 70, *t. 30, f. 1,* cited as a synonym, is clearly identical with the common and widely distributed *Blechnum orientale* Linn.

STENOCHLAENA J. Smith

STENOCHLAENA PALUSTRIS (Burm. f.) Bedd. Ferns Brit. Ind. Suppl. (1876) 234.

Polypodium palustre Burm. f. Fl. Ind. (1768) 234. "Habitat in indiis."

Burman apparently had a Javan specimen, as he cites the local Javanese name as *daun peekou,* although his description is a compiled one from pre-Linnean authors. The species is perhaps typified by the reference to Linn. Fl. Zeyl. 200 and to Burm. Thes. Zeyl. 100, *t. 46.* The species is a well-known one of wide distribution in the Indo-Malayan region.

HEMIONITIS Linnaeus

HEMIONITIS ARIFOLIA (Burm. f.) Moore Index (1859) 114.

Asplenium arifolium Burm. f. Fl. Ind. (1768) 231. "Habitat in India."

A well-known characteristic species of wide distribution in the Indo-Malayan region.

ADIANTUM Linnaeus

ADIANTUM PHILIPPENSE Linn. Sp. Pl. (1753) 1094.

Adiantum (*Adianthum*) *lunulatum* Burm. f. Fl. Ind. (1768) 235. "Habitat in Malabara & Java."

The actual type was apparently a Javan specimen, the Malabar reference being apparently added either from *Avenka* Rheede Hort. Malabar. **12**: 72, *t. 40,* or from Petiver Gaz. *t. 54, f. 10,* both cited as representing the species. The Linnean binomial is the oldest one for this well-known species, which is very common and widely distributed in the Philippines.

CHEILANTHES Swartz

CHEILANTHES TENUIFOLIA (Burm. f.) Sw. Syn. (1806) 129, 332.
Trichomanes tenuifolia Burm. f. Fl. Ind. (1768) 237.

The type is an actual specimen from Pryon, probably of Javan origin. *Dryopteris campestris* Rumph. Herb. Amb. 6: 77, *t. 34, f. 2,* is cited by Burman as representing his var. β. The Rumphian figure is an excellent illustration of the common and widely distributed *Cheilanthes tenuifolia* Sw.

PTERIS Linnaeus

PTERIS ENSIFORMIS Burm. f. Fl. Ind. (1768) 230. "Habitat in Zeylona & Java."

This is a common and well-known species of wide distribution in the Indo-Malayan region, extending to China, Polynesia, and Australia.

PTERIS VITTATA Linn. Sp. Pl. (1753) 1074.
Polypodium trapezoides Burm. f. Fl. Ind. (1768) 233, *t. 66, f. 2.* "Habitat in Java."

Burman's figure clearly represents a juvenile form of the very common Indo-Malayan species currently known as *Pteris longifolia* Linn. Hieronymus considers that the Old World *Pteris vittata* Linn. is specifically distinct from the tropical American *Pteris longifolia* Linn.

POLYPODIUM Linnaeus

POLYPODIUM SCOLOPENDRIUM Burm. f. Fl. Ind. (1768) 232 (*scolopendria*). "Habitat in India."
Polypodium phymatodes Linn. Mant. 2 (1771) 306.

The actual type of the species is doubtless Pryon's Javan specimen for which the local name *daun sembang* is cited. Pre-Linnean references are given to Burman Thes. Zeyl. 196, *t. 86,* Breynius Cent. 190, *t. 98, f. 1–3,* Morison Hist. 3, *f. 14, t. 1, f. 17,* Plukenet Mant. 82, Almath. 94, and Phyt. 404, *f. 1, 5.* Burman's specific name will replace the Linnean one for this very common and widely distributed species. Linnaeus in his description of *Polypodium phymatodes* gives the same references as does Burman f. to Burman and to Plukenet. It is probable that his actual type was material transmitted to him by Burman.

CYCLOPHORUS Desvaux

* **CYCLOPHORUS LONGIFOLIUS** (Burm. f.) Desv. in Berl. Mag. 5 (1811) 301.

Acrosticum longifolium Burm. f. Fl. Ind. (1768) 228. "Habitat in Java."

Burman's description is the basis of *Cyclophorus longifolius* Desv., a species of uncertain status within the genus, but in all probability a synonym of *C. adnascens* (Sw.) Desv., or *C. varius* (Kaulf.) Gaudich. The description was based on a Javan specimen collected by Pryon, and a reference to *Asplenium longifolium* Petiver Gaz. 310, *t. 61, f. 2, 4.* His specific name is older than either of these or than *Cyclophorus acrostichoides* (Forst.) Presl, another suggested reduction of the species, but the exact status of *Acrosticum longifolium* Burm. f. cannot be determined from the imperfect description alone.

GLEICHENIACEAE

GLEICHENIA Smith

GLEICHENIA LINEARIS (Burm. f.) C. B. Clarke in Trans. Linn. Soc. Bot. 1 (1880) 428.

Polypodium lineare Burm. f. Fl. Ind. (1768) 235, *t. 66, f. 4.* "Habitat in Java."

Burman's actual type is a Javan specimen. He adds a reference to Linn. Fl. Zeyl. 201. The species is a well-known and characteristic one of wide distribution, and Burman's excellent figure leaves no doubt as to the exact form intended by his description.

SCHIZAEACEAE

LYGODIUM Swartz

LYGODIUM PEDATUM (Burm. f.) Sw. in Shrad. Journ. 1800² (1801) 106.

Ophioglossum pedatum Burm. f. Fl. Ind. (1768) 227, *t. 66, f. 1.*
Ophioglossum circinnatum Burm. f. op. cit. 228.
Lygodium circinnatum Sw. Syn. (1806) 153.

Ophioglossum pedatum Burm. f. was based on a Javan specimen, and *O. circinnatum* Burm. f. on a Javan specimen with a reference to *Adianthum volubili polypodioides* Rumph. Herb. Amb. 6: 76, *t. 33,* and Petiver Gaz. *t. 64, f. 10.* Page priority will involve the acceptance of Burman's specific name *pedatum,* for both of his descriptions apply to a single well-known and widely distributed species.

PTERIDOPHYTA OF DOUBTFUL STATUS

* **POLYPODIUM ADIANTHOIDES** Burm. f. Fl. Ind. (1768) 234. "Habitat in Indiis."

Burman's description was based on an actual specimen collected by Pryon, probably of Javan origin. The reference to Petiver Fil. 69 *t. 2. f. 9,* cannot be interpreted as the type of the species. The species is unrecognizable from the short description alone, but it is probably no *Polypodium.*

* **POLYPODIUM GLABRUM** Burm. f. Fl. Ind. (1768) 235. "Habitat in Java, Zeylona."

The type is apparently a Javan specimen collected by Pryon; Burman added a reference to *Filix non ramosa, foliis integris non serratis, zeylanica minor* Burm. Thes. Zeyl. (1737) 100, which is unrecognizable from the description and which may or may not represent the same species as the Javan fern. Burman's species is unrecognizable from the description alone.

* **POLYPODIUM OVATUM** Burm. f. Fl. Ind. (1768) 233. "Habitat in Java."

The very brief description "fronde petiolata alterna, laciniis oblongis integerrimis" was based on a Javan specimen, but the identity of the species cannot be determined from the description alone. The species cannot be interpreted from the reference to Petiver Fil. 38, *t. 14, f. 2,* as this characterizes the variety β of Burman's species.

* **POLYPODIUM ROSTRATUM** Burm. f. Fl. Ind. (1768) 235. "Habitat in India."

This species was based on an actual specimen collected by Pryon with a reference to Plukenet Mant. 80, *t. 399, f. 4.* Burman compares it to *Polypodium decussatum* Linn., which is a *Dryopteris.* The species is unrecognizable from the description alone, but is evidently no *Polypodium.*

* **TRICHOMANES NIVEA** Burm. f. Fl. Ind. (1768) 237. "Habitat in utraque India."

There is little evidence that Burman had a specimen except in his statement "in utraque India." It is probable that he had a specimen from India or Java. I have not seen Sloane's figure which Burman cites as representing the species. The species is one of unknown status.

SPERMATOPHYTA

GYMNOSPERMAE

TAXACEAE

PODOCARPUS Persoon

PODOCARPUS JAVANICUS (Burm. f.) comb. nov.

Thuja ? javanica Burm. f. Fl. Ind. (1768) 202 (err. typ. 302), *t. 64, f. 3.* "Habitat in Java."
Podocarpus imbricatus Blume Enum. Pl. Jav. (1827) 89; Pilger in Engl. Pflanzenreich 18 (1903) 56.
Podocarpus cupressina R. Br. ex Mirb. in Mém. Mus. Paris 13 (1825) 75.

This is clearly a form of the species commonly known as *Podocarpus imbricatus* Blume, as indicated by the description of the upper leaves on the branchlets as lanceolate and again as plane and ovate-lanceolate. The figure presents a branch with branchlets covered with the small, imbricate, greatly reduced leaves, the tips of the branchlets presenting the transition stage to the much larger, differently shaped, distichous ones. Burman's name, being much the older, should be adopted for this well-known and widely distributed Malayan species.

ANGIOSPERMAE

MONOCOTYLEDONS

GRAMINEAE

PANICUM Linnaeus

PANICUM PUNCTATUM Burm. f. Fl. Ind. (1768) 26. "Habitat in India."

This was apparently based on *Gramen paniceum, multiplici spica, maderaspatanum* Pluken. Phyt. 174, *t. 191, f. 1.* The specimen in the Sloane herbarium, British Museum, on which Plukenet's description was based, is extant and is the form described as Burman's species by Hooker f. Fl. Brit. Ind. 7 (1897) 29.

PENNISETUM L. C. Richard

PENNISETUM GLAUCUM (Linn.) R. Br. Prodr. (1810) 195.

Panicum glaucum Linn. Sp. Pl. (1753) 56.
Panicum americanum Linn. l. c.
Pennisetum typhoideum A. Rich. in Pers. Syn. 1 (1805) 72.
Alopecurus typhoides Burm. f. Fl. Ind. (1768) 27.

No locality is cited, the species apparently being typified by *Gramen alopecuroides, spica maxima Indiae orientalis* Pluken.

Almag. 174, *t. 32, f. 4.* It is clearly identical with the species currently known as *Pennisetum typhoideum* A. Rich. in Pers. Syn. 1 (1805) 72, the generally accepted name of the species. However, this name is antedated by *Holcus spicatus* Linn. Syst. ed. 10 (1759) 1305, typified by the same reference to Plukenet, and further by *Panicum americanum* Linn. Sp. Pl. (1753) 56, and by *Panicum glaucum* Linn l. c., the latter having page priority. Additional synonyms are: *Pennisetum spicatum* R. & S., and *Pennisetum americanum* K. Schum. in Engl. Pflanzenw. Ostafr. B (1895) 51. Munro, Journ. Linn. Soc. Bot. 24 (1887) 136, has shown that the type of *Panicum glaucum* Linn. is a *Pennisetum*, not a *Setaria.* See Hitchcock in Am. Journ. Bot. 2 (1915) 300, and Chase op. cit. 8 (1921) 41–49.

SPINIFEX Linnaeus

SPINIFEX LITTOREUS (Burm. f.) Merr. in Philip. Journ. Sci. 7 (1912) Bot. 229, Interpret. Herb. Amb. (1917) 92.

Stipa littorea Burm. f. Fl. Ind. (1768) 29.
Stipa spinifex Linn. Mant. 1 (1767) 84.
Spinifex squarrosus Linn. Mant 2 (1771) 300.

No locality is cited, but Burman gives pre-Linnean references to India, Ceylon, and Amboina, and cites the Javanese name *rompot laut;* all of these refer to the species commonly known as *Spinifex squarrosus* Linn. The earliest valid specific name is that supplied by Burman's publication.

ELEUSINE Gaertner

ELEUSINE LAGOPOIDES (Burm. f.) comb. nov.

Cynosurus lagopoides Burm. f. Fl. Ind. (1768) 29. "Habitat Coromandeli."
Eleusine brevifolia R. Br. in Wall. Cat. (1831) No. 3815, *nomen nudum;* Hook. f. Fl. Brit. Ind. 7 (1897) 294.
Dactylis brevifolia Willd. Sp. Pl. 1 (1797) 410.

This is reduced in Index Kewensis to *Aeluropus pubescens* Trin., which is a synonym of *Aeluropus villosus* Trin. = *Aeluropus lagopoides* (Linn.) Trin., which Burman otherwise described and figured as *Dactylis lagopoides;* see page 340. Burman's *Cynosurus lagopoides* is apparently identical with the species currently known as *Eleusine brevifolia* R. Br., so that it would seem that the new combination is necessary for this species. *Eleusine lagopoides* (Burm. f.) Merr. and *Aeluropus lagopoides* (Linn.) Trin. are very badly confused in the early botanical literature.

DACTYLOCTENIUM Willdenow

DACTYLOCTENIUM AEGYPTIUM (Linn.) Richt. Pl. Europ. 1 (1889) 68.

Cynosurus aegyptius Linn. Sp. Pl. (1753) 72.

Dactylis geniculatus Burm. f. Fl. Ind. (1768) 28, *t. 12, f. 3.* "Habitat in Java."

Spartina geniculata Beauv. Agrost. (1812) 25.

Although the rather poor drawing does not show the characteristic mucronate tip of the rachis, and further presents but three spikes, this is clearly referable to the very common species currently known as *Dactyloctenium aegyptiacum* Willd. The only other possibility is *Eleusine corocana* (Linn.) Gaertn., which Burman otherwise described in the same work as *Cynosurus corocanus* Linn.

AELUROPUS Trinius

AELUROPUS LAGOPOIDES (Linn.) Trin. ex Thwaites Enum. Pl. Zeyl. (1864) 374 (*lagopodioides*).

Dactylis lagopoides Linn. Mant. 1 (1767) 33.

Dactylis lagopoides Burm. f. Fl. Ind. (1768) 28, *t. 12, f. 2.*

Aeluropus villosus Trin. Fund. Agrost. (1820) 143; Hook. f. Fl. Brit. Ind. 7 (1897) 334.

No locality is cited, but three references are given to pre-Linnean literature. The species was described by Linnaeus one year earlier as *Dactylis lagopoides* Linn. Burman's species may have included two distinct forms, but his figure is clearly the species currently known as *Aeluropus villosus* Trin.; he gives a reference to *Gramen dactyloides javanicum* Garzin herb., but no representative of the genus *Aeluropus* is known from Java.

CYPERACEAE

CYPERUS Micheli

CYPERUS ROTUNDUS Linn. Sp. Pl. (1753) 45.

Schoenus tuberosus Burm. f. Fl. Ind. (1768) 19. "Habitat in Java & Malabara."

This reduction has been made from Burman's description; I have not seen the illustrations in Rheede and in Sloane which Burman cites as illustrating his species.

* **CYPERUS UMBELLATUS** Burm. f. Fl. Ind. (1768) 21. *t. 9, f. 1.*

No locality is given by Burman. Regarding this species C. B. Clarke in Hook. f. Fl. Brit. Ind. 6 (1893) 619 states "perhaps grass." The description and figure appear to be based on a mixture of two entirely distinct forms. The stem and leaves unmistakably represent a cyperaceous plant; the inflorescences are distinctly grasslike, and the statement that the peduncles are sheathed to the middle would indicate that the inflorescences, drawn as attached to the vegetative parts of a cyperaceous plant, are indeed the upper parts of grass culms.

FUIRENA Rottboell

FUIRENA UNCINATA (Willd.) Kunth Enum. Pl. 2 (1837) 184.
Scirpus uncinatus Willd. Sp. Pl. 1 (1797) 300.
Scirpus capitatus Burm. f. Fl. Ind. (1768) 21. "Habitat in India."

This reduction follows C. B. Clarke in Hook. f. Fl. Brit. Ind. 6 (1893) 666. Burman's specific name is much older than Kunth's but is invalidated in *Fuirena* by *F. capitata* Willd.

ELEOCHARIS R. Brown

ELEOCHARIS DULCIS (Burm. f.) Trin. ex Henschel Vita Rumph. (1833) 186; Merr. Interpret. Herb. Amb. (1917) 104.
Andropogon dulcis Burm. f. Fl. Ind. (1768) 219. "Habitat in India."
Hippuris indica Lour. Fl. Cochinch. (1790) 35.
Carex tuberosa Blanco Fl. Filip. (1837) 35.

This was based on *Cyperus dulcis* Rumph. Herb. Amb. 6: 7, *t. 3, f. 1.* The reference to Plukenet added by Burman typifies the var. β and cannot be interpreted as the type of the species. There is no evidence that Burman had an actual specimen.

* **ELEOCHARIS** sp.
Carex ovata Burm. f. Fl. Ind. (1768) 194 (err. typ. 294). "Java."

This has been placed as a wholly doubtful species of the section *Primocarex*, but I suspect that it does not belong in the genus, but perhaps in *Eleocharis* or possibly *Fimbristylis*, for no species of the section *Primocarex* is known from Java. The references to figures in Plukenet and Sloane cannot be interpreted as the type of the species in view of Burman's statement that he had a Javan specimen. I have seen neither of the figures cited.

SCLERIA Bergius

* **SCLERIA** sp.
Schoenus paniculatus Burm. f. Fl. Ind. (1768) 19. "Ilad. Javanis. ex India missa."

Burman's description conforms better with the characters of *Scleria bancana* Miq. than with any other species known to me, but Rheede's illustration cited by Burman as representing his species certainly does not represent Miquel's species. *Schoenus paniculatus* Burm. f. has been referred to *Scleria sumatrensis*

Retz. (which has strongly tessellated fruits) and to *S. elata* Thwaites (which also has tessellated fruits), while Burman described the fruits as "laevibus" and as "splendentia saepe nigricantibus." Burman's specific name is valid in *Scleria* and eventually should probably be taken up for some well-known Malayan species of the genus now appearing in literature under some other specific name. The word "ilad" is a Javanese name for various species of *Scleria*.

ARACEAE

RHAPHIDOPHORA Hasskarl

RHAPHIDOPHORA LACINIATA (Burm. f.) comb. nov.

Polypodium laciniatum Burm. f. Fl. Ind. (1768) 231. "Habitat in Java & Malabara."

Pothos pertusus Roxb. Fl. Ind. 1 (1820) 455.

Rhaphidophora pertusa Schott in Bonpl. 5 (1857) 45; Engl. & Krause in Engl. Pflanzenreich 37 (1908) 47.

Burman states regarding his Javan specimen, for which he cites the local names *kakajar* and *tally kassa*, that the leaves lacked the perforations, but these are by no means constant in this species. From Burman's reference to *Elettadi maravara* Rheede Hort. Malabar. **12**: 41, *t. 20, 21*, it is clear that his species is a *Rhaphidophora*, identical with the species commonly known as *R. pertusa* (Roxb.) Schott, which extends from India to Java. Burman's specific name, being much the older, should be adopted.

COMMELINACEAE

COMMELINA Plumier

COMMELINA PAPILIONACEA Burm. f. Fl. Ind. (1768) 17 *t. 7, f. 1*. "Habitat Coromandeli."

Commelina salicifolia Roxb. Fl. Ind. 1 (1820) 176.

Burman's species is clearly identical with the one later described by Roxburgh as *Commelina salicifolia* and, although it is not mentioned by C. B. Clarke in his monograph of the Commelinaceae[8] his specific name should be retained for the species.

COMMELINA NUDIFLORA Linn. Sp. Pl. (1753) 41.

Commelina diffusa Burm. f. Fl. Ind. (1768) 18, *t. 7, f. 2*. "Habitat Coromandeli."

Burman's species is clearly a form of the ubiquitous *Commelina nudiflora* Linn., where it was placed as a synonym by C. B. Clarke.

---

[8] DC. Monog. Phan. 3 (1881) 113–324.

COMMELINA BENGHALENSIS Linn. Sp. Pl. (1753) 41.

Commelina nervosa Burm. f. Fl. Ind. (1768) 18, *t. 7, f. 3*. "Habitat Coromandeli."

C. B. Clarke was certainly correct in placing Burman's species as a synonym of *Commelina benghalensis* Linn., a very common plant in the Indo-Malayan region.

ANEILEMA R. Brown

ANEILEMA MALABARICUM (Linn.) Merr. in Philip. Journ. Sci. 7 (1912) Bot. 232.

Tradescantia malabarica Linn. Sp. Pl. ed. 2 (1762) 412.
Commelina nudiflora Linn. Mant. 2 (1771) 177, non Linn. 1753.
Commelina nudicaulis Burm. f. Fl. Ind. (1768) 17, *t. 18, f. 1*. "Java."
Aneilema nudiflorum R. Br. Prodr. (1810) 271.

The figure and description clearly indicate that Burman's species is identical with the very common Indo-Malayan form currently known as *Aneilema nudiflorum* R. Br.

PONTEDERIACEAE

MONOCHORIA Presl

MONOCHORIA VAGINALIS (Burm. f.) Presl Rel. Haenk. 1 (1827) 128.

Pontederia vaginalis Burm. f. Fl. Ind. (1768) 80.

Burman's species was based on pre-Linnean references to Rheede and to Plukenet. The same species was described under the same binomial three years later by Linnaeus Mant. 2 (1771) 222. A common plant in the Indo-Malayan region.

ZINGIBERACEAE

LANGUAS Koenig

(*Alpinia* auct., non Linnaeus)

LANGUAS MALACCENSIS (Burm. f.) comb. nov.

Maranta malaccensis Burm. f. Fl. Ind. (1768) 2. "Habitat in Malacca."
Alpinia malaccensis Rosc. in Trans. Linn. Soc. 8 (1807) 330, non Roxb., nec K. Schum.
Alpinia nobilis Ridl. in Journ. Str. Branch Roy. As. Soc. 32 (1899) 169.

Burman's binomial typifies *Alpinia malaccensis* Rosc., a species that has apparently been misinterpreted by modern authors; see Valeton in Merr. Interpret. Herb. Amb. (1917) 155. The type of the genus *Alpinia*, as described by Linnaeus, is *Alpinia racemosa*, of tropical America, which currently appears in botanical literature as *Renealmia racemosa* (L.) A. Rich. This is the only species of *Alpinia* that was known to Linnaeus; hence it must be the generic type. The proper application of the generic name *Alpinia* is to the numerous American species now known as *Renealmia,* the latter generic name falling as a synonym. Among the numerous synonyms of *Alpinia* auct., non Linn., *Languas* is the earliest available one for the numerous Old World species currently but erroneously referred to *Alpinia.*

ORCHIDACEAE

GALEOLA Loureiro

* **GALEOLA** sp.

Cassytha corniculata Burm. f. Fl. Ind. (1768) 93, *t. 33, f. 1.* "Habitat in Java."

The type was a Javan specimen collected by Kleinhof. The reference to *Cassutha cornea* Rumph. Herb. Amb. 7: 52 must be excluded as it refers to the mycelium of *Marasmius.* Dr. J. J. Smith, in answer to my suggestion that Burman's species might be a *Galeola,* states in lit., July 12, 1918, that he is convinced that it is either *Galeola altissima* Blume or *G. pterosperma* Schltr., the drawing representing the upper part of a plant. The "thorns" represent the roots; the "floruli imperfecti" probably are the young branches or young floral branches which often appear in the axils of the scales.

DENDROBIUM Swartz

DENDROBIUM CANINUM (Burm. f.) comb. nov.

Epidendrum caninum Burm. f. Fl. Ind. (1768) 189. "Habitat in India."

Dendrobium crumenatum Sw. in Schrad. Journ. 2 (1799) 237.

This was apparently based on a Javan specimen, judging from the Javanese name cited, *angrec utan,* and is unquestionably the very common and widely distributed species currently known as *Dendrobium crumenatum* Sw. The Rumphian reference *Angraecum caninum* Rumph. Herb. Amb. 6: 105, *t. 47, f. 2,* represents the very closely allied *D. papilioniferum* J. J. Sm., of the Moluccas. I propose to adopt Burman's name in place of Swartz's for this very common and well-known species.

* **DENDROBIUM** sp. § *Aporum.*

Epidendrum articulatum Burm. f. Fl. Ind. (1768) 189. "In India ex arboribus dependet."

This was apparently based on an actual specimen collected by Pryon, in Java (?). The only other reference given is to *Herba supplex quinta* Rumph. Herb. Amb. 6: 111, *t. 51, f. 2,* which is *Dendrobium calceolum* Roxb. Whatever Burman's species may ultimately prove to be, it is clearly a *Dendrobium* of the section *Aporum*.

DICOTYLEDONS

SALICACEAE

SALIX Tournefort

SALIX CHINENSIS Burm. f. Fl. Ind. (1768) 211 (err. typ. 311). "Habitat in China and Java."

This would appear to be identical with the later *Salix japonica* Thunb. Fl. Jap. (1784) 24, *t. 31,* which is common in Japan and in China, and which has long been cultivated in Java. It is to be noted that Koorders, Exkursionsfl. Java 2 (1912) 44, cites among other Javan specimens in the herbaria at Leiden and Utrecht a specimen "Kultiviert, ohne Fundort (Herbar Javan. Burman fide Blume = *S. Japonica*)." Burman's name, being the older, should be retained.

MORACEAE

FICUS Tournefort

FICUS AMPELOS Burm. f. Fl. Ind. (1768) 226. "Habitat in India."

Burman gives, in addition to his short descriptive sentence, first, a reference to *Folium politorium* Rumph. Herb. Amb. 4: 128, *t. 63,* and second, one to *Teregam* Rheede Hort. Malabar. 3: 79, *t. 60;* these two forms certainly are not conspecific. The species should be interpreted from the first reference and is, I believe, the form amply described by Koorders and Valeton, Bijdr. Boom. Java 11 (1906) 162, under Burman's binomial.

* **FICUS GROSSULARIOIDES** Burm. f. Fl. Ind. (1768) 227. "Habitat in Suratta."

This has been reduced to *Ficus heterophylla* Linn. f. Suppl. (1781) 442, which, if the correct disposition of it, would involve the acceptance of Burman's specific name for the species. It is probable that this reduction was based on the identity of *Valli-teregam* Rheede Hort. Malabar. 3: 83, *t. 62,* which Burman cites as representing his variety β, and which manifestly represents *Ficus heterophylla* Linn. f. Burman's very short description was based on an actual specimen collected by Garcin.

* **FICUS MONTANA** Burm. f. Fl. Ind. (1768) 226. "Habitat in India."

The short description was based on a Javan specimen collected by Kleinhof. The description is entirely too short and imperfect to permit the correct interpretation of the species.

FICUS PADANA Burm. f. Fl. Ind. (1768) 226.

Ficus toxicaria Linn. Mant. 2 (1771) 305.

The description was based on a Sumatran specimen and is the form described three years later as *Ficus toxicaria* Linn. Linnaeus cites Burman's species as a synonym. The two descriptions were doubtless based on material originating from the same collection. Burman's name, being the older, should be retained.

FICUS PYRIFOLIA Burm. f. Fl. Ind. (1768) 226. "Habitat in Japonia."

From the very short description it is believed that this will prove to be identical with *Ficus erecta* Thunb. Ficus (1786) 9, in which case Burman's name should replace Thunberg's.

FICUS SEPTICA Burm. f. Fl. Ind. (1768) 226. "Habitat in India."

Burman apparently had a Javan specimen, as he cites the Javanese name *siri bipar* for the species, but he also adds references to Rumphius and to Rheede. The Rumphian reference, which is the first one given, represents the widely distributed species commonly known as *Ficus leucantatoma* Poir.; but I believe that Burman's *Ficus septica* should be adopted in its stead, as it is the oldest valid name for this particular species.

FICUS TSJAKELA Burm. f. Fl. Ind. (1768) 227. "Habitat in Malabara."

This was based on a specimen collected by Garcin "*Ficus surattensis & malabarica, mori folio,*" and *Tsjakela* Rheede Hort. Malabar. 3: 87, *t. 64*. It has been badly confused with *Ficus infectoria* Roxb., and is really *Ficus infectoria* Willd., non Roxb. It is the valid name for a species of India and Ceylon, fully described and figured by King, in Ann. Bot. Gard. Calcutta 1 (1887) 57, *t. 70,* who has there adjusted the synonymy, on page 61. It is entirely different from *Ficus tsiela* Roxb.

URTICACEAE

BOEHMERIA Jacquin

BOEHMERIA PLATYPHYLLA D. Don Prodr. Fl. Nepal. (1825) 60.

Urtica caudata Burm. f. Fl. Ind. (1768) 198 (err. typ. 298). "Habitat in Java."

Boehmeria caudata J. J. Sm. in Koord. & Val. Bijdr. Boom. Java 12 (1910) 706, non Sw.

Weddell reduced Burman's species to *Boehmeria platyphylla* D. Don. var. *scabrella* Wedd. in DC. Prodr. 16^{1} (1859) 311, and it is clearly a form of Don's species.

BOEHMERIA NIVEA (Linn.) Gaudich. Bot. Freyc. Voy. (1826) 499.
Urtica nivea Linn. Sp. Pl. (1753) 985.
Urtica candicans Burm. f. Fl. Ind. (1768) 197 (err. typ. 297). "Habitat in Java."

This is clearly a synonym of *Boehmeria nivea* (Linn.) Gaudich., placed by Weddel as the variety *candicans* Wedd. of the above species.

POUZOLZIA Gaudichaud

POUZOLZIA ZEYLANICA (Linn.) Benn. Pl. Jav. Rar. (1838) 67.
Parietaria zeylanica Linn. Sp. Pl. (1753) 1052.
Parietaria indica Linn. Mant. 1 (1767) 128.
Parietaria indica Burm. f. Fl. Ind. (1768) 211. "Habitat in Java."
Pouzolzia indica Gaudich. Bot. Freyc. Voy. (1826) 503.

It is suspected that both the Linnean and the Burman *Parietaria indica* were based on material of similar origin. The species is synonymous with the earlier *Parietaria zeylanica* Linn.=*Pouzolzia zeylanica* (Linn.) Benn.

DEBREGEASIA Gaudichaud

DEBREGEASIA LONGIFOLIA (Burm. f.) Wedd. in DC. Prodr. 16^{1} (1869) 235^{24}.
Urtica longifolia Burm. f. Fl. Ind. (1768) 197 (err. typ. 297). "Habitat in Java."

This is the basis of *Debregeasia longifolia* (Burm. f.) Wedd., a well-known species of wide distribution on the mountains of the Indo-Malayan region. The Philippine *Debregeasia angustifolia* C. B. Rob. does not appear to be distinct from the Javan form, although differing slightly from Indian material.

PROTEACEAE

SYNAPHEA R. Brown

SYNAPHEA SPINULOSA (Burm. f.) Merr. in Proc. Linn. Soc. N. S. W. 44^{2} (1919) 354.
Polypodium spinulosum Burm. f. Fl. Ind. (1768) 233, *t. 67, f. 1.*
Synaphea polymorpha R. Br. in Trans. Linn. Soc. 10 (1810) 156.

From the excellent figure this is manifestly the proteaceous *Synaphea polymorpha* R. Br., of western Australia, this involving the acceptance of Burman's specific name. The figure is excellently matched by Australian specimens before me. It would seem that the locality cited by Burman as "Java" is an error.

LORANTHACEAE

VISCUM Tournefort

VISCUM ARTICULATUM Burm. f. Fl. Ind. (1768) 211 (err. typ. 311).
"Habitat in Java."

This species, at least in a broad sense, is of very wide distribution in the Indo-Malayan region. *Aspidixia articulata* Van Tiegh. is a synonym.

AMARANTHACEAE

CELOSIA Linnaeus

CELOSIA ARGENTEA Linn. Sp. Pl. (1753) 205.
Celosia pyramidalis Burm. f. Fl. Ind. (1768) 65, *t. 25, f. 1.* "Ex Java per semina allata * * *."

The description and figure refer to but a single species, which appears to be *Celosia argentea* Linn. rather than *C. cristata* Linn.; in Index Kewensis the species is reduced to *C. cristata* Linn. and *Allmania albida* R. Br.

AERUA Forskål

AERUA PERSICA (Burm. f.) comb. nov.
Iresine persica Burm. f. Fl. Ind. (1768) 212 (err. typ. 312), *t. 60, f. 1.*
Iresine javanica Burm. f. l. c. *t. 60, f. 2.*
Celosia lanata Linn. Sp. Pl. (1753) 205, non *Aerua lanata* Juss.
Aerua javanica Juss. in Ann. Mus. Paris 11 (1808) 131.

Iresine persica Burm. f. was based on a Persian specimen and *I. javanica* Burm. f. on one from Java. Both figures and descriptions apparently are referable to a single species, the former species being a more robust form than the latter.

AIZOACEAE

MOLLUGO Linnaeus

MOLLUGO LOTOIDES (Linn.) C. B. Clarke in Hook. f. Fl. Brit. Ind. 2 (1879) 662, 776.
Glinus lotoides Linn. Sp. Pl. (1753) 463; Burm. f. Fl. Ind. (1768) 112, *t. 36, f. 1.*
Mollugo hirta Thunb. Fl. Cap. (1794) 24.
Glinus ononides Burm. f. Fl. Ind. (1768) 113, *t. 36, f. 2.*
Glinus dictamnoides Burm. f. l. c.

The type of *Glinus ononides* Burm. f. was probably a Javan specimen, as Burman cites Pryon as the collector and gives the Malay name as *aud-gam pait.* It is apparently a form of *Mollugo lotoides* (Linn.) C. B. Clarke, which Burman describes on the preceding page as *Glinus lotoides* Linn. The type of *Glinus dictamnoides* Burm. f. was from India and can scarcely be other than a form of *Mollugo lotoides* (Linn.) C. B. Clarke.

MOLLUGO PENTAPHYLLA Linn. Sp. Pl. (1753) 89.

Mollugo paniculata Burm. f. Fl. Ind. (1768) 32. "Habitat in Zeylona."

Burman's species is typified by *Alsine lutea ramosissima pentaphylla polyanthos* Burm. Thes. Zeyl. (1737) 12, *t. 6, f. 2.* It is nearly the typical obovate-leaved form of *Mollugo pentaphylla* Linn. Sp. Pl. (1753) 89, to which the lanceolate to narrowly lanceolate-leaved form, *Mollugo stricta* Linn., is usually reduced as a synonym.

MOLLUGO OPPOSITIFOLIA Linn. Sp. Pl. (1753) 89.

Mollugo erecta Burm. f. Fl. Ind. (1768) 32.
Mollugo triphylla Burm. f. l. c.

The reference to Burman, Thesaurus Zeylanicus (1737) 13, *t. 7,* places *Mollugo erecta* Burm. f. definitely as a synonym of *Mollugo oppositifolia* Linn., although it would seem that Trimen, Fl. Ceyl. 2 (1894) 271, considered it rather a synonym of the very different *Mollugo pentaphylla* Linn. I can see no reason for distinguishing *Mollugo triphylla* Burm. f. from *M. erecta* Burm. f. = *M. oppositifolia* Linn. Burman's material of *Mollugo erecta* was from Ceylon and that of *M. triphylla* was from India.

TRIANTHEMA Linnaeus

TRIANTHEMA DECANDRA Linn. Mant. 1 (1767) 70.

Zaleya decandra Burm. f. Fl. Ind. (1768) 110, *t. 36, f. 1.* "Coromandeli."

Both binomials were doubtless based on material of similar origin. A well-known and widely distributed plant.

BASELLACEAE

BASELLA Linnaeus

BASELLA RUBRA Linn. Sp. Pl. (1753) 272.

Basella japonica Burm. f. Fl. Ind. (1768) 76, *t. 39, f. 4.* "Habitat in Japonia."

This is clearly referable to the Linnean species.

CARYOPHYLLACEAE

COMETES Linnaeus

COMETES SURATTENSIS Linn. Mant. 1 (1767) 39.

Cometes surattensis Burm. f. Fl. Ind. (1768) 39, *t. 15, f. 5.*

This was based on Indian material. The species was described one year earlier by Linnaeus under the same binomial, the material described by both authors doubtless being parts of the same collection.

NYMPHAEACEAE

NYMPHAEA Tournefort

NYMPHAEA NOUCHALI Burm. f. Fl. Ind. (1768) 120. "Habitat Coromandeli."

Nymphaea pubescens Willd. Sp. Pl. 2 (1799) 1154.

This is tentatively reduced in Index Kewensis to *Nymphaea stellata* Willd., but it would seem that, in spite of the description of the flowers as "caeruleo," it is the same as *Nymphaea pubescens* Willd. (1797), in which case Burman's name should be adopted for the species. Conard, The Waterlilies, Carnegie Inst. Washington Publ. 4 (1905) 198, *t. 17,* cites Burman's species as a synonym of Willdenow's on the basis of an actual specimen examined by him: "coll. [that is, ex herb.] Burman in India, in hb. Delessert."

MENISPERMACEAE

TINOSPORA Miers

* **TINOSPORA** sp.

Menispermum glabrum Burm. f. Fl. Ind. (1768) 216 (err. typ. 316). "Habitat in Java."

The reference to *Cit-amerdu* Rheede Hort. Malabar. 7: 39, *t. 21,* should be excluded, as it represents *Tinospora cordifolia* (DC.) Miers, a species of wide distribution in India, but which does not extend to Java; Burman's species was based on an actual Javan specimen. I cannot determine, from the short description or from the Javanese name cited, *daun tayonam,* the proper status of Burman's species, except that it apparently belongs in the Menispermaceae; it may prove to be the same as *Tinospora rumphii* Boerl. It is not accounted for by Diels in his recent monograph of the Menispermaceae, Engl. Pflanzenreich 46 (1910) 1 345.

SCIENTIFIC LI
INSTITUTE OF SC
(Formerly Bureau of
Manila

MAGNOLIACEAE

MICHELIA Linnaeus

MICHELIA CHAMPACA Linn. Sp. Pl. (1753) 536.

Michelia euonymoides Burm. f. Fl. Ind. (1768) 124. "Habitat in Indiis."

Burman's species is certainly only a form of the earlier *Michelia champaca* Linn.; the Javanese name cited by Burman is one of those still in use in Java for the Linnean species. The Rumphian synonym cited represents *Michelia tsiampacca* Linn., whatever that may ultimately prove to be. I have not seen Sloane's figure which Burman also cites as a synonym, but it probably does not represent Burman's species.

LAURACEAE

CINNAMOMUM Blume

*** CINNAMOMUM** sp.

Laurus malabatrum Burm. f. Fl. Ind. (1768) 92. "Habitat in Malabaria & Amboina."

There is no description, the species being based on references to Rumphius, Rheede, and "*Malabathrum malabaricum* Garcin. herb." The reference to Rumphius represents *Cinnamomum javanicum* Blume. Burman's species is manifestly typified by the Malabar specimen and the reference to Rheede, and is hence identical with the form described by Solander as *Laurus malabathrica* Soland. in Roxb. Fl. Ind. ed. 2, 2 (1832) 297. Hooker f., Fl. Brit. Ind. 5 (1886) 136, was unable to place it to his satisfaction.

CRUCIFERAE

FORTUYNIA Shuttleworth

FORTUYNIA GARCINI (Burm. f.) Shuttl. ex Boiss. in Ann. Sci. Nat. Bot. II 17 (1842) 178.

Peltaria garcini Burm. f. Fl. Ind. (1768) 139, *t. 46, f. 1* (*garzini*). "Habitat in Persia."

The species is known only from Persia.

NASTURTIUM Linnaeus

NASTURTIUM INDICUM (Linn.) DC. Syst. 2 (1821) 199.

Sisymbrium indicum Linn. Mant. 1 (1767) 93.
Sisymbrium indicum Burm. f. Fl. Ind. (1768) 140.
Sisymbrium sinapis Burm. f. l. c.

This species is widely distributed in the Indo-Malayan region. *Sisymbrium sinapis* Burm. f. was based on Javan material, while that on which *S. indicum* Burm. f. was based was from India. Doubtless the material Linnaeus had in describing the species one year earlier was a part of the same collection.

NASTURTIUM HETEROPHYLLUM Blume Bijdr. (1825) 50.

* ? *Cardamine indica* Burm. f. Fl. Ind. (1768) 140. "Habitat in Java."

De Candolle, who saw Burman's specimen in the Delessert herbarium, retained this in *Cardamine,* with the comment "An potius inter Nasturtia ad sectionem Clandestinariae referenda?" while Schulz, Monogr. Gattung Cardamine in Engl. Bot. Jahrb. 32 (1903) 594, states that it is a *Nasturtium.* I suspect that it is the same as *Nasturtium heterophyllum* Blume. Burman's specific name, however, is invalidated in *Nasturtium* by *N. indicum* (Linn.) DC.

FARSETIA Turra

FARSETIA CANESCENS (Willd.) comb. nov.

Heliophila canescens Willd. Sp. Pl. 3 (1800) 528.
Arabis heliophila DC. Syst. 2 (1821) 237, Prodr. 1 (1824) 147.
Heliophila incana Burm. f. Fl. Ind. (1768) 140, *t. 46, f. 2,* non *Farsetia incana* R. Br. "Habitat in India."
Farsetia jacquemontii Hook. f. & Th. Fl. Ind. 1 (1855) 140.

De Candolle's and Willdenow's binomials are based on Burman's description; the latter's specific name being invalidated in *Farsetia,* I propose to adopt Willdenow's specific name. *Farsetia jacquemontii* Hook. f. & Th. is clearly a synonym.

LEGUMINOSAE

PROSOPIS Linnaeus

PROSOPIS SPICIGERA Linn. Mant. 1 (1767) 68.

Prosopis spicata Burm. f. Fl. Ind. (1768) 102. "Habitat Coromandeli."

This was described one year earlier by Linnaeus and is a well-known Indian species. Both descriptions were doubtless based on material from the same collection.

ACACIA Willdenow

ACACIA TRUNCATA (Burm. f.) Hort. ex Hoffmsg. Pfl. Verz. (1824) 34.

Adianthum truncatum Burm. f. Fl. Ind. (1768) 235, *t. 66, f. 4.* "Habitat in India."
Acacia decipiens R. Br. in Ait. Hort. Kew. ed. 2, 5 (1813) 463.

Kleinhof's specimen cited by Burman is credited to Java, the locality being certainly an error. Captain van Alderwereldt van Rosenburgh informs me that the species does not grow in Java, although the reduction of *Adianthum truncatum* Burm. f. to *Acacia decipiens* R. Br., indicated in Index Kewensis and in Christensen's Index Filicum, is certainly correct. The type was undoubtedly from western Australia, erroneously localized as Javan. *Polypodium spinulosum* Burm. f. = *Synaphea polymorpha* R. Br. presents a parallel case.

SARACA Linnaeus

SARACA INDICA Linn. Mant. 1 (1767) 98.

> *Saraca arborescens* Burm. f. Fl. Ind. (1768) 85, *t. 25, f. 2.* "Habitat in Java."

Burman's species is clearly identical with the Linnean one published one year earlier, both descriptions doubtless being based on material from the same collection.

DIALIUM Linnaeus

DIALIUM INDUM Linn. Mant. 1 (1767) 24.

> *Dialium javanicum* Burm. f. Fl. Ind. (1768) 12. "Habitat in Java."

Burman's species is clearly identical with the one described one year earlier by Linnaeus; both descriptions were doubtless based on material of the same collection. *Cortex papetarius* Rumph. Herb. Amb. 3: 212, *t. 137*, which is cited by Burman as a synonym, must be excluded, as it represents *Weinmannia fraxinea* Sm.

CASSIA Tournefort

CASSIA SURATTENSIS Burm. f. Fl. Ind. (1768) 97.

> *Cassia glauca* Lam. Encycl. 1 (1783) 647.

The description was based on "*Senna surattensis* Garzin. herb." It is apparently correctly placed as a synonym of *Cassia glauca* Lam. in spite of Burman's description of it as "herbaceus." Burman's name is much older than that proposed by Lamarck and should be retained.

SOPHORA Linnaeus

SOPHORA JAPONICA Linn. Mant. 1 (1767) 68.

> *Sophora japonica* Burm. f. Fl. Ind. (1768) 93. "Habitat in Japonia."

This is a well-known species of wide distribution in China and Japan. Both descriptions were probably based on specimens from the same collection.

CROTALARIA Dillenius

CROTALARIA NANA Burm. f. Fl. Ind. (1768) 156, *t. 48, f. 2.* "Habitat in India."

This species is a well-known one of India and Ceylon.

CROTALARIA PERSICA (Burm. f.) comb. nov.

Cytisus persicus Burm. f. Fl. Ind. (1768) 163, *t. 51, f. 1.* "Habitat in Persia."
Spartium persicum Willd. Sp. Pl. 3 (1800) 931.
Crotalaria furfuracea Boiss. Diagn. 1 ^{2} (1843) 6.

De Candolle, Prodr. 2 (1825) 157, retains this as a doubtful species of *Cytisus*, giving an amplified description from Burman's specimen in the Delessert herbarium. It is apparently identical with *Crotalaria furfuracea* Boiss.

CROTALARIA QUINQUEFOLIA Linn. Sp. Pl. (1753) 716.

Lupinus javanicus Burm. f. Fl. Ind. (1768) 157. "Habitat in Java."

The genus *Lupinus* is represented in Java by but three species, all casual and apparently recent introductions. From Burman's description it is quite evident that he had flowering specimens of *Crotalaria quinquefolia* Linn., in spite of the fact that the corolla is described as "purpurascens." In this species of *Crotalaria* the flowers are yellow, although the petals are often tinged with purple on the outside.

CROTALARIA SERICEA Burm. f. Fl. Ind. (1768) 156. "Habitat in India."

Crotalaria burmanni DC. Prodr. 2 (1825) 126.

This is the basis of *Crotalaria burmanni* DC., the new name having been proposed because of *Crotalaria sericea* Retz. (1783), which, however, manifestly does not invalidate Burman's specific name. Baker, in Hook. f. Fl. Brit. Ind. 2 (1876) 75, places *Crotalaria sericea* Burm. f. and *C. burmanni* DC. as doubtful synonyms of *Crotalaria assamica* Benth.

ASPALATHUS Linnaeus

ASPALATHUS ANTHYLLOIDES Linn. Sp. Pl. ed. 2 (1763) 1002.

Lotus persicus Burm. f. Fl. Ind. (1768) 173, *t. 49, f. 3.* "Habitat in Persia."
Anthyliis asphaltoides Linn. Cent. Pl. 2 (1756) 183, Amoen. Acad. 4 (1759) 326.
Ononis ? asphaltoides DC. Prodr. 2 (1825) 167.

De Candolle, who examined Burman's type in the Delessert herbarium, referred it with doubt to the genus *Ononis*, with the comment "sed descr. et patriae dubiae remanent." The Linnean species is South African; it would seem, therefore, that Burman was in error in accrediting his species to Persia.

ONONIS Linnaeus

ONONIS PERSICA Burm. f. Fl. Ind. (1768) 157, *t. 49, f. 1.* "Habitat in Persia."

This is supposed to be a synonym of *Ononis sicula* Guss.; this being so, Burman's specific name is much the older and should be retained.

LOTUS Tournefort

LOTUS GARCINI DC. Prodr. 2 (1825) 212.

Aspalathus persica Burm. f. Fl. Ind. (1768) 155. "Habitat in Persia & Malabaria."

The Persian specimen, the type of the species, is a *Lotus*, and Burman's name is the basis of *Lotus garcini* DC. The reference to Rheede Hort. Malabar. 9: 71, *t. 38*, must be excluded, as it does not represent the species Burman actually described. The type is in the Delessert herbarium. The specific name *persica* is invalidated in *Lotus* by *Lotus persicus* Burm. f.

INDIGOFERA Linnaeus

INDIGOFERA COLUTEA (Burm. f.) comb. nov.

Galega colutea Burm. f. Fl. Ind. (1768) 172. "Habitat in India."
Tephrosia colutea Pers. Syn. 2 (1807) 326.
Indigofera viscosa Lam. Encycl. 3 (1789) 247.

This species is currently known as *Indigofera viscosa* Lam., but Burman's specific name is older and should be retained.

INDIGOFERA ARGENTEA Burm. f. Fl. Ind. (1768) 171. "Habitat in Persia."

Burman's name antedates *Indigofera argentea* Linn. Mant. 2 (1771) 273 and should be maintained, with *Indigofera semitrijuga* Forsk. as a synonym. The proper name for the species described by Linnaeus as *Indigofera argentea* is *I. articulata* Gouan., for his species does not seem to have been based on specimens of the same collection as Burman's.

INDIGOFERA ENNEAPHYLLA Linn. Mant. 2 (1771) 272.

Hedysarum prostratum Linn. Mant. 1 (1767) 102, non *Indigofera prostrata* Perr.
Hedysarum prostratum Burm. f. Fl. Ind. (1768) 168, *t. 55, f. 1.* "Coromandeli."

Hedysarum prostratum of Linnaeus and of Burman were doubtless based on material of similar origin. It is a synonym of *Indigofera enneaphylla* Linn.

TEPHROSIA Persoon

TEPHROSIA VILLOSA (Linn.) Pers. Syn. 2 (1807) 329.

Galega villosa Linn. Syst. ed. 10 (1759) 1172.
Galega barba-jovis Burm. f. Fl. Ind. (1768) 172. "Habitat in India."

Burman's name is a synonym of the earlier Linnean one.

TAVERNIERA de Candolle

TAVERNIERA SPARTEA (Burm. f.) DC. Prodr. 2 (1825) 339.

Hedysarum sparteum Burm. f. Fl. Ind. (1768) 166, *t. 51, f. 3* (err. *f. 2*). "Habitat in India."

De Candolle examined Garcin's specimen in the Delessert herbarium on which Burman's species was based; he indicates that this was from Persia rather than from India. *Taverniera nummularia* DC. is probably not specifically distinct.

DESMODIUM Desvaux

DESMODIUM HETEROCARPUM (Linn.) DC. Prodr. 2 (1825) 337.

Hedysarum heterocarpon Linn. Sp. Pl. (1753) 747.
Hedysarum siliquosum Burm. f. Fl. Ind. (1768) 169, *t. 55, f. 2.* "Java."
Desmodium siliquosum DC. Prodr. 2 (1825) 336.
Desmodium polycarpum DC. op. cit. 334.

Burman's species is clearly identical with the very common Indo-Malayan *Desmodium heterocarpum* (Linn.) DC., more commonly known as *D. polycarpum* DC.

DESMODIUM CAPITATUM (Burm. f.) DC. Prodr. 2 (1825) 336.

Hedysarum capitatum Burm. f. Fl. Ind. (1768) 167, *t. 54, f. 1.*

No definite locality is given, but Burman's specimen was from either Java or India. This is the basis of the well-known and widely distributed *Desmodium capitatum* (Burm. f.) DC.

DESMODIUM TRIFLORUM (Linn.) DC. Prodr. 2 (1825) 334.

Hedysarum triflorum Linn. Sp. Pl. (1753) 749.
Hedysarum stipulaceum Burm. f. Fl. Ind. (1768) 168, *t. 54, f. 2.* "Crescit in Persia."

Burman's species has been reduced to *Desmodium triflorum* (Linn.) DC., a very common species in most tropical countries; this doubtless is the correct disposition of it, as the figure agrees with *Desmodium triflorum* DC.

ALYSICARPUS Necker

ALYSICARPUS MONILIFER (Linn.) DC. Prodr. 2 (1825) 353.

Hedysarum moniliferum Linn. Mant. 1 (1767) 102.
Hedysarum moniliforme Burm. f. Fl. Ind. (1768) 168, *t. 52, f. 3.* "Coromandeli."

Burman's species is clearly identical with the one described a year earlier by Linnaeus; both descriptions were doubtless based on material from the same collection. It is widely distributed in India.

URARIA Desvaux

URARIA CRINITA (Linn.) Desv. Journ. Bot. 1 (1813) 123.

Hedysarum crinitum Linn. Mant. 1 (1767) 102.

Hedysarum crinitum Burm. f. Fl. Ind. (1768) 169, *t. 56.* "Habitat in Java."

A characteristic Indo-Malayan species, both Burman's and Linnaeus's binomials doubtless being based on material of similar origin.

PONGAMIA Ventenat

PONGAMIA PINNATA (Linn.) Merr. Interpret. Herb. Amb. (1917) 271.

Cytisus pinnatus Linn. Sp. Pl. (1753) 741.

Robinia mitis Linn. op. cit. ed. 2 (1763) 1044.

Robinia javanica Burm. f. Fl. Ind. (1768) 163. "Habitat in Java."

Burman's species was based on a flowering specimen, and in view of this fact it is scarcely possible that it is a synonym of *Cassia sulfurea* DC. = *Cassia glauca* Lam., to which it has been reduced and which Burman otherwise described as *Cassia surattensis* Burm. f. The description is entirely inadequate, consisting only of the statement: "caule inermi foliis pinnatis sex jugis, pedunculis simplicibus multifloris." Burman's species is apparently identical with the common and widely distributed *Pongamia pinnata* (Linn.) Merr., currently known as *Pongamia glabra* Vent.

ELEIOTIS de Candolle

ELEIOTIS MONOPHYLLA (Burm. f.) DC. Mém. Legum. 7 (1825) 350, Prodr. 2 (1825) 348.

Glycine monophyllos Burm. f. Fl. Ind. (1768) 161, *t. 50, f. 2.* "Habitat Coromandeli."

Hedysarum sororium Linn. Mant. 2 (1771) 270.

Eleiotis sororia DC. l. c.

Burman's specific name has priority and should be retained for this species. The description of Burman and that of Linnaeus were doubtless based on material from the same collection.

TERAMNUS P. Browne

TERAMNUS UNCINATUS (Linn.) Sw. Prodr. (1783–87) 105.

Dolichos uncinatus Linn. Sp. Pl. ed. 2 (1763) 1019.

Dolichos uncinatus Burm. f. Fl. Ind. (1768) 161. "Habitat in India utraque."

There is no evidence that Burman's binomial was intended to represent *Dolichos uncinatus* Linn., although it probably represents the Linnean species which is the basis of *Teramnus uncinatus* (Linn.) Sw. Burman's actual type is clearly Kleinhof's specimen, as he notes that the specimen differed somewhat from Plukenet's figure, Phyt. 290, *t. 214, f. 2,* which he cites as representing the species. The Linnean species is typified by Plumier Spec. 8. *ic. 221;* there is no specimen in the Linnean herbarium.

PHASEOLUS Tournefort

PHASEOLUS TRILOBATUS (Linn.) Baill. in Bull. Soc. Linn. Paris 1 (1883) 379.

Dolichos trilobatus Linn. Mant. 1 (1767) 101.
Glycine triloba Burm. f. Fl. Ind. (1768) 162. "Habitat in Java."
Glycine triloba Linn. Mant. 2 (1771) 442.
Dolichos trilobus Ait. Hort. Kew. 3 (1789) 30.

In describing *Glycine triloba,* Linnaeus cites Burman's publication and gives as synonyms *Dolichos trilobatus* Linn. Mant. 1 (1767) 101, and *Phaseolus aconitifolius* Jacq. Obs. 3 (1764–71) 2, *t. 52.* Jacquin's species is generally considered a distinct one, while the proper name for the form Linnaeus described is *Phaseolus trilobatus* (Linn.) Baill. *Dolichos trilobatus* (Linn.) Baill. occurs in Java, but Jacquin's species is not reported from that island.

VIGNA Savi

VIGNA SINENSIS (Linn.) Savi ex Hassk. Cat. Hort. Bogor. (1844) 279.

Dolichos sinensis Linn. Cent. Pl. 2 (1756) 28.
Dolichos catjang Burm. f. Fl. Ind. (1768) 161. "Habitat in India."
Dolichos catjang Linn. Mant. 2 (1771) 259.
Vigna catjang Walp. in Linnaea 13 (1839) 533.

If Burman's species be typified by the first reference to an illustration, and the reference from which he took his specific name, namely, Malay *Katjang poeti, Phaseolus minor* Rumphius Herb. Amb. 5: 383, *t. 139, f. 1,* it is identical with *Vigna cylindrica* (Linn.) Skeels in U. S. Dept. Agr. Bur. Pl. Industry Bull. 282 (1913) 32; Merr. Interpret. Herb. Amb. (1917) 284 [*Phaseolus cylindricus* Linn. Amoen. Acad. 4 (1759) 132]. There is no direct evidence that Burman had an actual specimen. The catjang, however, does not appear to be specifically distinct from the cowpea, *Vigna sinensis* (Linn.) Savi.

ZYGOPHYLLACEAE

FAGONIA Tournefort

FAGONIA CRETICA Linn. Sp. Pl. (1753) 386.

Fagonia indica Burm. f. Fl. Ind. (1768) 102, *t. 34, f. 1.* "Habitat in Persia."

This is apparently a synonym of the Linnean species, where it has long been placed as a synonym.

RUTACEAE

MURRAYA Koenig

MURRAYA PANICULATA (Linn.) Jack in Malay Miscel. 1^5 (1820) 31.

Chalcas paniculata Linn. Mant. 1 (1767) 68.
Chalcas camuneng Burm. f. Fl. Ind. (1768) 104. "Habitat in Java."
Murraya exotica Linn. Mant. 2 (1771) 563.

A variable species of wide distribution in Asia and Malaysia, now pantropic in cultivation.

CLAUSENA Burman f.

CLAUSENA EXCAVATA Burm. f. Fl. Ind. (1768) 87 (*Claucena*), 243. "Habitat in Java."

This is the original publication of the genus. Burman's original spelling was *Claucena,* apparently a typographical error for *Clausena,* as he gives it in the index to his work as *Clausena.* The name, according to Wittstein, was derived from P. Clausön, a Danish botanist. The species is a well-known one of wide distribution in the Indo-Malayan region.

TRIPHASIA Loureiro

TRIPHASIA TRIFOLIA (Burm. f.) P. Wils. in Torrea 9 (1909) 33.

Limonia trifolia Burm. f. Fl. Ind. (1768) 103, *t. 35* (err. typ. 34), *f. 1.* "Habitat in Java."
Limonia trifoliata Linn. Mant. 2 (1771) 237.
Triphasia trifoliata DC. Prodr. 1 (1824) 536.
Triphasia aurantiola Lour. Fl. Cochinch. (1790) 153.

A very common and widely distributed Indo-Malayan species for which Burman's binomial supplies the earliest specific name. The Linnean description was doubtless based on material of the same collection as that on which Burman's was based.

FERONIA Correa

FERONIA LIMONIA (Linn.) Swingle in Journ. Wash. Acad. Sci. 4 (1914) 328; Merr. Interpret. Herb. Amb. (1917) 293.

Schinus limonia Linn. Sp. Pl. (1753) 389.
Feronia elephantum Correa in Trans. Linn. Soc. 5 (1800) 225.
Limonia acidissima Burm. f. Fl. Ind. (1768) 102. "Habitat in India."

Burman's binomial was probably not intended as a new one, but was doubtless intended as the Linnean species of the same name, Sp. Pl. ed. 2 (1762) 554.

RUTACEAE OF UNCERTAIN STATUS

* **SOLANUM TRIFOLIATUM** Burm. f. Fl. Ind. (1768) 57, *t. 22, f. 3.*

The reduction given in Index Kewensis to *Triphasia aurantiola* Lour. is an impossible one, the latter being described and figured by Burman as *Limonia trifolia,* Fl. Ind. (1768) 103, *t. 35, f. 1.* The two figures present nothing in common, but depict two entirely different plants. *Solanum trifoliatum* Burm. f. apparently represents some rutaceous plant.

BURSERACEAE

PROTIUM Burman f.

PROTIUM JAVANICUM Burm. f. Fl. Ind. (1768) 88. "Habitat in Java."

Amyris protium Linn. Mant. 1 (1767) 65.

The description is based on an actual specimen, with a reference to *Tingulong* Rumph. Auct. 54, *t. 23, f. 1,* which represents the same species. It typifies the genus. The Linnean *Amyris protium* was doubtless based on material originating from the same source as Burman's type.

MELIACEAE

SANDORICUM Cavanilles

SANDORICUM KOETJAPE (Burm. f.) Merr. in Philip. Journ. Sci. 7 (1912) Bot. 237, Interpret. Herb. Amb. (1917) 308.

Melia koetjape Burm. f. Fl. Ind. (1768) 101. "Habitat in Java."
Sandoricum indicum Cav. Diss. 4 (1787) 359, *t. 202, 203.*

Burman's species is clearly identical with the common and widely distributed Indo-Malayan species currently known as *Sandoricum indicum* Cav. *Koetjape* is the common Javanese name for the species.

EUPHORBIACEAE

ANTIDESMA Burman

ANTIDESMA BUNIUS (Linn.) Spreng. Syst. 1 (1825) 826.

Stilago bunius Linn. Mant. 1 (1767) 122.
Stilago bunius Burm. f. Fl. Ind. (1768) 16. "Habitat in India."

A very common Indo-Malayan species, described by Linnaeus one year earlier than by Burman and under the same binomial. Both descriptions were doubtless based on material of similar origin.

CROTON Linnaeus

CROTON GLABRESCENS Miq. Fl. Ind. Bat. 1^2 (1858–59) 382.

Croton castaneifolium Burm. f. Fl. Ind. (1768) 205 (err. typ. 305), *t. 64, f. 1*, non Linn. "Habitat in Java."

Burman's figure represents a true *Croton* and is apparently the same as *Croton glabrescens* Miq.

CROTON OBLONGUM Burm. f. Fl. Ind. (1768) 205 (err. typ. 305), *t. 64, f. 2.*

Croton laevifolius Blume Bijdr. (1825) 603.

No locality is cited, and the entire description consists of the words "foliis oblongo-ovatis integerrimis." Burman's material was probably from Java, and from the figure it is clearly identical with the form later described as *Croton laevifolius* Blume. Burman's name should be retained for the species.

CROTON TIGLIUM Linn. Sp. Pl. (1753) 1004.

? Croton racemosum Burm. f. Fl. Ind. (1768) 206 (err. typ. 306), *t. 62, f. 2.*

The type of this was apparently a Javan specimen, and from the description and figure I can suggest no other reduction than *Croton tiglium* Linn., although the description of the leaves as tomentose scarcely applies to the Linnean species. The form indicated as var. *β*, based on *Beénel* Rheede Hort. Malabar. 5: 7, *t. 4*, is certainly not congeneric with *Croton racemosum* Burm. f.

CLAOXYLON A. Jussieu

CLAOXYLON POLOT (Burm. f.) Merr. Interpret. Herb. Amb. (1917) 200.

Croton polot Burm. f. Fl. Ind. (1768) 205 (err. typ. 305). "Habitat in Amboina & Java."
Claoxylon indicum Hassk. Cat. Hort. Bogor. (1844) 235.

Burman based his description on an actual Javan specimen, which must typify his species in spite of the fact that he took his specific name from *Folium urens s. polot* Rumph. Herb. Amb. 3: 217, *t. 141*. The specimen described is clearly the species commonly known as *Claoxylon indicum* Hassk. The Rumphian reference must be excluded, as it represents *Laportea amplissima* (Blume) Miq.

CLEIDION Blume

CLEIDION SPICIFLORUM (Burm. f.) Merr. Interpret. Herb. Amb. (1917) 322.

Acalypha spiciflora Burm. f. Fl. Ind. (1768) 203 (err. typ. 303), *t. 61, f. 2.* "Habitat in India utraque."
Cleidion javanicum Blume Bijdr. (1825) 613.

The form figured and hence the type of Burman's species is clearly the one commonly known as *Cleidion javanicum* Blume, with staminate inflorescences. The references to Plukenet, P. Browne, Rheede, Burman, and Rumphius must be excluded, as none of these pre-Linnean citations represents the form that Burman f. figured and described.

ACALYPHA Linnaeus

ACALYPHA HISPIDA Burm. f. Fl. Ind. (1768) 203 (err. typ. 303), *t. 61, f. 1.* "Habitat in India."

Caturus spiciflorus Linn. Mant. 1 (1767) 127, non *Acalypha spiciflora* Burm. f.
Acalypha densiflora Blume Bijdr. (1826) 628.
Acalypha sanderi N. E. Br. in Gard. Chron. (1896) 2: 392.

This is a species of wide distribution in the Indo-Malayan region in cultivation, and is also cultivated for ornamental purposes in Europe and America. It was later described as *Acalypha densiflora* Blume, and as recently as 1896 as *A. sanderi* N. E. Br. The earlier *Caturus spiciflorus* Linn. Mant 1 (1767) 127 is invalidated by *Acalypha spiciflora* Burm. f.

RICINUS Linnaeus

RICINUS COMMUNIS Linn. Sp. Pl. (1753) 1007.

Ricinus speciosus Burm. f. Fl. Ind. (1768) 207 (err. typ. 307), *t. 63, f. 2.* "Habitat in Java."

This is certainly a form of *Ricinus communis* Linn., with very narrow leaf-segments and unusually deep sinuses.

ANACARDIACEAE

RHUS Tournefort

RHUS JAVANICA Linn. Sp. Pl. (1753) 265.

Schinus indica Burm. f. Fl. Ind. (1768) 215 (err. typ. 315). "Habitat in India."
Rhus semialata Murr. in Comm. Gotting. 6 (1784) 27, *t. 3.*

There is nothing in the description by which the identity of this species can be determined with absolute certainty, it consisting only of the statement: "Foliis pinnatis, foliolis ovatis serratis impari aequali, petiolis alatis subcanaliculatis." The type probably came from Java, which being so the species is clearly no *Schinus,* all species of which are American. It can scarcely be other than a synonym of *Rhus javanica* Linn., more commonly known as *R. semialata* Murr.

SAPINDACEAE

ALLOPHYLUS Linnaeus

ALLOPHYLUS TRIPHYLLUS (Burm. f.) comb. nov.

Usubis triphylla Burm. f. Fl. Ind. (1768) 89, *t. 32, f. 1.* "Habitat in Java."

Allophylus javensis Blume Rumphia 3 (1847) 183.

Burman's species has been reduced to *Allophylus cobbe* (Linn.) Blume, *sensu lat.,* but the latter is limited to India and Ceylon. *Usubis triphylla* is clearly identical with *Allophylus javensis* Blume.

RHAMNACEAE

ZIZYPHUS Tournefort

ZIZYPHUS JUJUBA (Linn.) Lam. Encycl. 3 (1789) 318.

Rhamnus jujuba Linn. Sp. Pl. (1753) 194.

Rhamnus nummularia Burm. f. Fl. Ind. (1768) 61, saltem pro parte. "Habitat in Zeylona & Java."

It is suspected that two or more species are included in the references given by Burman. The Javan reference to Pryon is probably *Zizyphus jujuba* (Linn.) Lam., there being no other Javan species known to which the descriptive sentence applies. "Rhamnus persica herb. Garzin." probably appertains to *Zizyphus rotundifolia* Lam. The Ceylon references probably appertain to *Zizyphus jujuba* Lam. and *Z. oenoplia* Mill.

ZIZYPHUS SPINI-CHRISTI (Linn.) Willd. Sp. Pl. 1 (1797) 1105.

Rhamnus spini-christi Linn. Sp. Pl. (1753) 195.

Rhamnus heterogenea Burm. f. Fl. Ind. (1768) 61. "Habitat in India orientali & Persia."

Burman's species is apparently referable to *Zizyphus spini-christi* (Linn.) Willd.

SCUTIA Commerson

SCUTIA MYRTINA (Burm. f.) comb. nov.

Rhamnus myrtinus Burm. f. Fl. Ind. (1768) 60. "Habitat Coromandeli."

Scutia indica Brongn. in Ann. Sci. Nat. I 10 (1827) 363.

Scutia commersonii Brongn. l. c.

It would seem that Burman's specific name should be adopted for this Asiatic and Madagascar species.

VITACEAE

LEEA Royen

LEEA INDICA (Burm. f.) Merr. in Philip. Journ. Sci. 14 (1919) 245.

Staphylea ? indica Burm. f. Fl. Ind. (1768) 75, *t. 24, f. 2.* "Habitat in Indiis."

Aquilicia sambucina Linn. Mant. 2 (1771) 211.

Leea sambucina Willd. Sp. Pl. 1 (1797) 1177.

From the description and figure Burman's species is clearly identical with the widely distributed form currently known as *Leea sambucina* Willd., the latter being based on the Linnean binomial, and the Linnean binomial in turn typified by Burman's description.

MALVACEAE

ABUTILON Tournefort

ABUTILON PERSICUM (Burm. f.) comb. nov.

Sida persica Burm. f. Fl. Ind. (1768) 148, *t. 47, f. 1.* "Habitat in Persia."

Sida polyandra Roxb. Hort. Beng. (1814) 50, Fl. Ind. ed. 2, 3 (1832) 173.

Abutilon polyandrum Schlecht. in Link Enum. Hort. Berol. 2 (1822) 264.

Burman's species is clearly identical with *Abutilon polyandrum* (Roxb.) Schlecht., to which it is reduced by Masters in Hook. f. Fl. Brit. Ind. 1 (1874) 325. Burman's specific name should be adopted for the species.

SIDA Linnaeus

SIDA ACUTA Burm. f. Fl. Ind. (1768) 147. "Habitat in India."

This is the earliest valid name for this very common and widely distributed species; it was later described by the younger Linnaeus as *Sida carpinifolia* Linn. f. Suppl. (1781) 307.

SIDA RACEMOSA Burm. f. Fl. Ind. (1768) 148.

Sida mysorensis W. & A. Prodr. (1834) 59.

No habitat is cited. This species has been reduced to *Sida glutinosa* Cav., probably from confusion of Cavanilles's species with *Sida mysorensis* W. & A. The description applies very closely to *Sida mysorensis* W. & A., and it is believed that Burman's specific name should be retained for the Indo-Malayan form generally referred to the latter.

HIBISCUS Linnaeus

HIBISCUS PANDURAEFORMIS Burm. f. Fl. Ind. (1768) 151, *t. 47, f. 2.*

No species of *Althaea* (*Alcaea*) Burman, cultivated or other- No locality is cited, but the type was either Indian or Javan. The species is a well-known one, extending from India to tropical Africa, Java, and tropical Australia.

MALVACEAE OF UNCERTAIN STATUS

* **ALCAEA INDICA** Burm. f. Fl. Ind. (1768) 149. "Habitat in Java."

No species of *Althaea* (*Alcaea*) Burman, cultivated or otherwise, is reported from Java, and Burman's species has not been considered by any modern author. It is suspected that his specimen represents some species of *Hibiscus*, but the description alone is scarcely sufficient to determine this matter.

TILIACEAE

CORCHORUS Dillenius

CORCHORUS TRIDENS Linn. Mant. 2 (1771) 566.

Corchorus trilocularis Burm. f. Fl. Ind. (1768) 123, *t. 37, f. 2,* non Linn. "Habitat in India."

Burman's description and figure apparently belong with *Corchorus tridens* Linn., rather than with *C. trilocularis* Linn. Mant. 1 (1767) 77, at least as the two species are interpreted by Masters in Hook. f. Fl. Brit. Ind. 1 (1874) 397, 398.

STERCULIACEAE

MELOCHIA Dillenius

MELOCHIA CONCATENATA Linn. Sp. Pl. (1753) 675.

Melochia corchorifolia Linn. l. c.
Corchorus javanicus Burm. f. Fl. Ind. (1768) 123, *t. 36, f. 3.*
Melochia erecta Burm. f. op. cit. 143.

Burman's types of both species were from Java. From the distinctly good figure the first is manifestly synonymous with the species currently known as *Melochia corchorifolia* Linn., which is a synonym of *M. concatenata* Linn. The drawing is erroneous in that all the leaves are represented as alternate. *Melochia erecta* Burm. f. is clearly synonymous with *Corchorus javanicus* Burm. f.

* **MELOCHIA CORDATA** Burm. f. Fl. Ind. (1768) 143. "Coromandeli."

If this be a *Melochia* it can scarcely be other than a form of *Melochia concatenata* Linn., but the description of the flowers as yellow, solitary, and opposite the leaves, and the capsules as compressed scarcely conforms to the characters of the Linnean species.

DILLENIACEAE

TETRACERA Linnaeus

TETRACERA AKARA (Burm. f.) comb. nov.

Calophyllum akara Burm. f. Fl. Ind. (1768) 121. "Habitat in India."
Tetracera laevis Vahl Symb. 3 (1794) 71.

Burman's species is typified by *Akara patsjoti* Rheede Hort. Malabar. 5: 15 *t. 8*, this being an excellent illustration of the species commonly known as *Tetracera laevis* Vahl.

GUTTIFERAE

CALOPHYLLUM Linnaeus

CALOPHYLLUM SOULATTRI Burm. f. Fl. Ind. (1768) 121. "Habitat in Java."

Calophyllum spectabile Willd. in Ges. Naturf. Fr. Berl. Mag. 5 (1811) 80.

Burman's binomial is the oldest valid one for the well-known species described in 1811 as *Calophyllum spectabile* Willd.; Burman's name should be retained.

MESUA Linnaeus

MESUA FERREA Linn. Sp. Pl. (1753) 515.

Calophyllum nagassarium Burm. f. Fl. Ind. (1768) 121. "Habitat in Amboina & Java."

Burman's species is a synonym of the well-known *Mesua ferrea* Linn. *Nagassarium* Rumph. Herb. Amb. 7: 3, *t. 2*, cited by Burman as a synonym of his species, is correctly placed.

GARCINIA Linnaeus

GARCINIA sp.

Rheedia javanica Burm. f. Fl. Ind. (1768) 118. "Habitat in Java."

The description clearly applies to *Garcinia*, but the further identity of the species is scarcely determinable from the description alone.

COCHLOSPERMACEAE

COCHLOSPERMUM Kunth

COCHLOSPERMUM GOSSYPIUM (Linn.) DC. 1 (1824) 527.

Bombax gossypium Linn. Syst. ed. 12 (1767) 517.
Bombax conga Burm. f. Fl. Ind. (1768) 145. "Habitat in India."

Burman's species is identical with *Bombax gossypium* Linn., which was published one year earlier.

VIOLACEAE

IONIDIUM Ventenat

IONIDIUM SUFFRUTICOSUM (Linn.) Ging. in DC. Prodr. 1 (1824) 311.
Viola suffruticosa Linn. Sp. Pl. (1753) 937.
Polygala thea Burm. f. Fl. Ind. (1768) 154, excl. var. β.
Polygala theezans Linn. Mant. 2 (1771) 260.

No definite locality is given, but the species is based on two Ceylon references, one Javan, and perhaps one Japanese, and is unquestionably a mixture. If typified by the first and only illustrations cited, *Polygala frutescens, lavandulae folio, flore caeruleo. Burm. zeyl. 195, t. 85,* it is a synonym of *Ionidium suffruticosum* (Linn.) Ging., which is perhaps the best disposition of it. The native name *kimelala,* representing the variety β, *Kimelala Javanis, quae foliis ovalibus triplo majoribus,* is unquestionably *Polygala glomerata* Lour., now known in Java as *malela;* it is not the type of Burman's species. *Polygala theezans* Linn. Mant. 2 (1771) 260 is a new name for *Polygala thea* Burm. f. and should go with *Ionidium suffruticosum* (Linn.) Ging. as a synonym.

FLACOURTIACEAE

FLACOURTIA L'Héritier

FLACOURTIA INDICA (Burm. f.) Merr. Interpret. Herb. Amb. (1917) 377.
Gmelina indica Burm. f. Fl. Ind. (1768) 132, *t. 39, f. 5.* "Habitat in Java."
Flacourtia sepiaria Roxb. Pl. Coromandel 1 (1795) 48, *t. 68.*
Flacourtia ramontchi L'Hérit. Stirp. Nov. (1784–85) 59, *t. 30, 31.*

A common species in the Indo-Malayan region, for which Burman's binomial supplies the oldest valid specific name.

THYMELAEACEAE

PHALERIA Jack

PHALERIA OCTANDRA (Linn.) Baill. in Adansonia 11 (1876) 321.
Dais octandra Linn. Mant. 1 (1767) 69.
Dais octandra Burm. f. Fl. Ind. (1768) 104, *t. 32, f. 2.* "Habitat in Java."
Drimyspermum burmanni Decne. in Ann. Sci. Nat. II 19 (1843) 40.

A well-known Javan species, both Burman's and Linnaeus's descriptions doubtless being based on material of similar origin.

RHIZOPHORACEAE

BRUGUIERA Lamarck

BRUGUIERA CYLINDRICA (Linn.) Blume Enum. Pl. Jav. (1828) 93; Merr. Interpret. Herb. Amb. (1917) 388.

Rhizophora cylindrica Linn. Sp. Pl. (1753) 443.
Rhizophora caryophylloides Burm. f. Fl. Ind. (1768) 109. "Habitat in India."
Bruguiera caryophylloides Blume Enum. Pl. Jav. (1828) 93.

A widely distributed Indo-Malayan species currently known as *Bruguiera caryophylloides* Blume.

COMBRETACEAE

QUISQUALIS Linnaeus

QUISQUALIS INDICA Linn. Sp. Pl. ed. 2 (1762) 556.

Quisqualis pubescens Burm. f. Fl. Ind. (1768) 104, *t. 35, f. 2, t. 28, f. 2* (var. β *glabra*). "Habitat in Amboina."

Both drawings represent the well-known *Quisqualis indica* Linn.; Burman's species can be safely placed as a synonym of the Linnean one.

MYRTACEAE

PSIDIUM Linnaeus

PSIDIUM CUJAVILLUS Burm. f. Fl. Ind. (1768) 114. "Habitat in India."

Psidium pumilum Vahl Symb. 2 (1791) 56.
Psidium angustifolium Lam. Encycl. 3 (1789) 17.

Burman's binomial is the proper name for the species more commonly known as *Psidium pumilum* Vahl. His type was probably from Java. *Cujavillus* Rumph. Herb. Amb. 1: 145, *t. 49*, is correctly placed as a synonym.

EUGENIA Micheli

EUGENIA AQUEA Burm. f. Fl. Ind. (1768) 114. "Habitat in Amboina."

This is typified by *Jambosa aquea* Rumph. Herb. Amb. 1: 126, *t. 38, f. 2*, there being no evidence that Burman had a specimen. The species is widely distributed, in cultivation, in the Malayan region.

MELALEUCA Linnaeus

MELALEUCA LEUCADENDRON Linn. Mant. 1 (1767) 105 (*leucadendra*).

Myrtus leucadendra Linn. in Stickm. Herb. Amb. (1754) 9, Amoen. Acad. 4 (1759) 120, Syst. ed. 10 (1759) 1056, Sp. Pl. ed. 2 (1762) 676.
Myrtus saligna Burm. f. Fl. Ind. (1768) 116. "Habitat in Java & Amboina."

This is the well-known cajuput tree, widely distributed in Malaysia, in cultivation.

MELASTOMATACEAE

MEMECYLON Linnaeus

MEMECYLON UMBELLATUM Burm. f. Fl. Ind. (1768) 87. "Habitat in Zeylona."

This is the form amply described by Trimen, Fl. Ceyl. 2 (1894) 217, who states that *Memecylon umbellatum* Burm. f. was published without description. It is, however, a valid publication, as it is typified by the excellent figure cited, Burm. Thesaurus Zeylanicus (1737) *t. 31*.

OENOTHERACEAE

JUSSIEUA Linnaeus

JUSSIEUA SUFFRUTICOSA Linn. Sp. Pl. (1753) 388.

Jussiaea tenella Burm. f. Fl. Ind. (1768) 103, *t. 34* (err. typ. *35*), *f. 2*. "Habitat in Java."

This can scarcely be other than a form of the Linnean species, in spite of Burman's description of the leaves as opposite; in the drawing, which is good, some are drawn as alternate, others as opposite.

ARALIACEAE

NOTHOPANAX Miquel

NOTHOPANAX SCUTELLARIUM (Burm. f.) Merr. Interpret. Herb. Amb. (1917) 409.

Crassula ? scutellaria Burm. f. Fl. Ind. (1768) 78. "Java."
Aralia cochleata Lam. Encycl. 1 (1783) 224.
Panax cochleata DC. Prodr. 4 (1830) 253.

A species in common cultivation; its native habitat is uncertain.

ERICACEAE

RHODODENDRON Linnaeus

RHODODENDRON LEDIFOLIUM G. Don Gen. Syst. 3 (1834) 846.

Rhododendron burmanni G. Don l. c.
Rhododendron rosmarinifolium Dippel Handb. Laubholzk. 1 (1889) 421, non Vidal 1886.
Azalea rosmarinifolia Burm. f. Fl. Ind. (1768) 43, *t. 3*, *f. 3*. "Habitat in Japonia, colitur in Java."

Burman's species represents the well-known *Rhododendron ledifolium* G. Don, its identity having been kindly verified for me by Dr. B. Hayata. *Rhododendron rosmarinifolium* (Burm.

f.) Dippel (1889) is invalidated by *Rhododendron rosmarinifolium* Vidal (1886), the latter being an unrelated Philippine species.

MYRSINACEAE

EMBELIA Burman f.

EMBELIA RIBES Burm. f. Fl. Ind. (1768) 62, *t. 23*. "Habitat in Zeylonia."

The species is a well-known one and has been correctly interpreted by subsequent authors. It is the type of the genus.

SALVADORACEAE

SALVADORA Garcin

SALVADORA PERSICA Linn. Sp. Pl. (1753) 122.

Galenia asiatica Burm. f. Fl. Ind. (1768) 88, *t. 31, f. 1* (err. typ. *f. 5*). "Persia & Arabia."

Burman's species is a synonym of the earlier Linnean one.

OLEACEAE

JASMINUM Tournefort

JASMINUM ANGUSTIFOLIUM (Linn.) Willd. Sp. Pl. 1 (1797) 36.

Nyctanthes angustifolia Linn. Sp. Pl. (1753) 6.

Nyctanthes triflora Burm. f. Fl. Ind. (1768) 4, *t. 2*. "Habitat in Java."

Burman's species, from his excellent figure, seems to be identical with *Jasminum angustifolium* (Linn.) Willd., a species of India and Ceylon. The indicated place of origin, Java, is probably erroneous.

JASMINUM PUBESCENS (Retz.) Willd. Sp. Pl. 1 (1797) 37.

Nyctanthes pubescens Retz. Obs. 5 (1789) 9.

Nyctanthes multiflora Burm. f. Fl. Ind. (1768) 5, *t. 3, f. 1*. "Habitat in China & Malabaria."

Burman's species is apparently referable to *Jasminum pubescens* Willd., a species of wide distribution in tropical Asia, and one frequently cultivated for ornamental purposes. Burman's specific name is apparently invalidated by *Jasminum multiflorum* Roth.

OLEACEAE OF DOUBTFUL STATUS

***OLEA INDICA** Burm. f. Fl. Ind. (1768) 6. "Java."

This was based on Javan material, but the description is entirely inadequate, consisting only of the statement: "foliis lanceolatis subtus tomentosus * * * vix differt ab Europaea." The binomial does not appear in Index Kewensis.

GENTIANACEAE

ENICOSTEMA Blume

ENICOSTEMA VERTICILLATUM (Linn.) Engl. Pflanzenw. Ost-Afr. C (1895) 313; Engl. & Prantl Nat. Pflanzenfam. 4^2 (1895) 67, *f. 31.*

Gentiana verticillata Linn. Syst. ed. 10 (1759) 952; Burm. f. Fl. Ind. (1768) 73. "Coromandeli."

Enicostema littorale Blume Bijdr. (1826) 848.

Burman's species is clearly the same as the Linnean one of the same name, and perhaps he did not intend to describe it as a new one. It is commonly known as *E. littorale* Blume.

APOCYNACEAE

CARISSA Linnaeus

CARISSA CARANDAS Linn. Mant. 1 (1767) 52.

Capparis carandas Burm. f. Fl. Ind. (1768) 118, 119.

Echites spinosa Burm. f. op. cit. 69.

Burman's *Capparis carandas* is clearly based on *Carandas* Rumph. Herb. Amb. 7: 57, *t. 25,* and is a synonym of *Carissa carandas* Linn. The same binomial appears twice in Burman's work, in both cases based on the same Rumphian synonym. *Echites spinosa* Burm. f. seems also to be clearly referable to *Carissa carandas* Linn.

TABERNAEMONTANA Linnaeus

TABERNAEMONTANA DIVARICATA (Linn.) R. Br. ex Roem. & Schultes Syst. 4 (1819) 427.

Nerium divaricatum Linn. Sp. Pl. (1753) 209.

Nerium coronarium Jacq. Coll. 1 (1786) 138.

Nyctanthes acuminata Burm. f. Fl. Ind. (1768) 5. "In Java, Malabara, Zeylona indigena, translata a Portugallis ex Manilhis in Amboinam."

Tabernaemontana coronaria Willd. Enum. Hort. Berol. (1809) 275.

This is clearly *Tabernaemontana divaricata* (Linn.) R. Br., a species now pantropic in cultivation and more commonly known as *T. coronaria* Willd. It occurs in Manila only as an introduced and rarely cultivated plant and is not a native of the Philippines.

STROPHANTHUS de Candolle

STROPHANTHUS CAUDATUS (Burm. f.) Kurz in Journ. As. Soc. Beng. 46^2 (1877) 257.

Echites caudata Burm. f. Fl. Ind. (1768) 68, *t. 26.* "Habitat in Javae locis altioribus."

Strophanthus dichotomus DC. in Bull. Soc. Philom. 3 (1802) 123.

Burman's binomial typifies the species. It is more commonly known as *Strophanthus dichotomus* DC., and extends from Burma and Indo-China to Malaysia. *Nerium scandens* Lour. Fl. Cochinch. (1790) 116 = *Strophanthus scandens* R. & S. Syst. 4 (1819) 412 does not appear to be specifically distinct.

VALLARIS Burman f.

VALLARIS GLABRA (Linn.) O. Kuntze Rev. Gen. Pl. (1891) 417.

Pergularia glabra Linn. Mant. 1 (1767) 53.
Vallaris pergulanus Burm. f. Fl. Ind. (1768) 51. "Habitat in Java."
Emericia pergularia Roem. & Schultes Syst. 4 (1819) 401.

Burman's specific name should be retained for this well-known species. *Flos pergulanus* Rumph. Herb. Amb. 5: 51, *t. 29, f. 2*, is a synonym. It is probable that both Burman's and Linnaeus's descriptions were based on material of similar origin.

APOCYNACEAE OF DOUBTFUL STATUS

* **APOCYNUM VINCAEFOLIUM** Burm. f. Fl. Ind. (1768) 71.

The references are to "*Asclepias javanica angustifolia* Garzin. herb." and to an illustration of an American plant in Plukenet Alm. 35, *t. 260, f. 14*. It is clear that the two are neither conspecific nor congeneric. The short description is based on the Javan plant, but there are no data by which its identity can be safely determined; it is clearly no *Apocynum*.

* **ECHITES NUMMULARIA** Burm. f. Fl. Ind. (1768) 69, *t. 28, f. 1*. "Habitat in India."

I do not recognize the species figured; it is, however, distinctly characteristic. The citations to pre-Linnean literature added by Burman probably all represent species different from the one figured and described by him. It probably represents some apocynaceous plant.

* **JASMINUM OBLONGUM** Burm. f. Fl. Ind. (1768) 6, *t. 3, f. 2*. "Habitat in Java."

This was described and figured from Javan material; it is manifestly no *Jasminum*, but probably represents some apocynaceous plant.

ASCLEPIADACEAE

TELOSMA Coville

TELOSMA CORDATA (Burm. f.) comb. nov.

Asclepias cordata Burm. f. Fl. Ind. (1768) 72, *t. 27, f. 2*. "Habitat in Java."
Cynanchum odoratissimum Lour. Fl. Cochinch. (1790) 166.
Pergularia odoratissima Sm. Ic. (1790–93) *t. 16*.
Telosma odoratissima Coville in Contr. U. S. Nat. Herb. 9 (1905) 384.

The data given by Burman and the distinctly good figure clearly indicate that his species is the same as *Pergularia odoratissima* Sm. It is to be noted that the Javanese name *malatti tonquin*, cited by Burman from Kleinhof, is still used in Java for this species, being given by Koorders as *malati tungking*. The species is a native of southeastern Asia and, as the native name indicates, is an introduced one in Java; it is in general cultivation in the Indo-Malayan region for its very fragrant flowers. I do not consider *Pergularia minor* Andr. to be other than a synonym of *P. cordata* (Burm. f.) Merr. The generic name *Pergularia* of Linnaeus is the proper one for the African species long placed in *Daemia*. *Prageluria* N. E. Br. (1907) is a synonym of *Telosma*.

TYLOPHORA R. Brown

TYLOPHORA INDICA (Burm. f.) comb. nov.

Cynanchum indicum Burm. f. Fl. Ind. (1768) 70. "Narin-talie. Javanis. D. Outgaerden e Coromandel."

Asclepias asthmatica Linn. f. Suppl. (1781) 171.

Tylophora asthmatica Wight & Arn. in Wight Contrib. (1834) 51.

This is clearly the species commonly known as *Tylophora asthmatica* (Linn. f.) W. & A., as Hooker f. Fl. Brit. Ind. 4 (1883) 45 cites "*Cynanchum indicum* Herb. Burm." as a synonym of *T. asthmatica* W. & A. Burman's specific name is the oldest valid one for the species and should be adopted.

ASCLEPIADACEAE OF UNCERTAIN STATUS

* **PERIPLOCA DUBIA** Burm. f. Fl. Ind. (1768) 70. "Habitat in Java & Malabara."

This has been reduced to *Cryptolepis buchanani* R. & S., but it is evident that two species are involved. The reference to *Katu pal-valli* Rheede Hort. Malabar. 9: 15, *t. 11*, belongs with the Indian *Cryptolepis buchanani* R. & S. The Javan reference "Paepe-sajor. Javanis. *D. Kleinhof*" apparently typifies Burman's species, but the description is altogether too short to warrant a reduction of it from the description alone.

CONVOLVULACEAE

PORANIA Burman f.

PORANIA VOLUBILIS Burm. f. Fl. Ind. (1768) 51, *t. 21, f. 1.* "Habitat in Java."

A well-known species of wide distribution in southeastern Asia and Malaysia; the type of the genus.

JACQUEMONTIA Choisy

JACQUEMONTIA PANICULATA (Burm. f.) Hallier f. in Engl. Bot. Jahrb. 18 (1894) 95.

Ipomoea paniculata Burm. f. Fl. Ind. (1768) 50, *t. 21, f. 3.* "Habitat in Java."

Convolvulus parviflorus Vahl Symb. 3 (1794) 29.

A well-known and widely distributed species, for which Burman's specific name should be retained.

MERREMIA Dennstaedt

MERREMIA EMARGINATA (Burm. f.) Hallier f. in Engl. Bot. Jahrb. 16 (1892) 552.

Evolvulus emarginatus Burm. f. Fl. Ind. (1768) 77, *t. 30, f. 1.* "Habitat in India."

Convolvulus reniformis Roxb. Fl. Ind. 2 (1824) 67.

Ipomoea reniformis Choisy Conv. Or. (1834) 64.

A well-known and widely distributed Indo-Malayan species, more commonly known as *Ipomoea reniformis* Choisy.

MERREMIA GEMELLA (Burm. f.) Hallier f. in Engl. Bot. Jahrb. 16 (1892) 552.

Convolvulus gemellus Burm. f. Fl. Ind. (1768) 46, *t. 21, f. 1.* "Habitat in Java."

Ipomoea gemella Roth Nov. Pl. Sp. (1821) 110.

Ipomoea chrysedeis Ker in Bot. Reg. *t. 270.*

Burman's binomial is the basis of the well-known and widely distributed *Merremia gemella* Hallier f.

MERREMIA HEDERACEA (Burm. f.) Hallier f. in Engl. Bot. Jahrb. 18 (1894) 168.

Evolvulus hederaceus Burm. f. Fl. Ind. (1768) 77, *t. 30, f. 2.* "Habitat in Java."

Ipomoea polyantha Miq. Fl. Ind. Bat. 2 (1857) 613.

A well-known and widely distributed Malayan species.

MERREMIA VITIFOLIA (Burm. f.) Hallier f. in Engl. Bot. Jahrb. 16 (1892) 552.

Convolvulus vitifolius Burm. f. Fl. Ind. (1768) 45, *t. 18, f. 1.*

Convolvulus angularis Burm. f. op. cit. 46, *t. 19, f. 2.*

Burman's material was from Java, *Merremia vitifolia* (Burm. f.) Hallier f. being a characteristic, well-known species. I can see no reason for distinguishing *Convolvulus angularis* Burm. f., for Burman describes its flowers as yellow, although including a reference to Pryon "flore purpureo." The reference to Pryon should probably be excluded.

IPOMOEA Linnaeus

IPOMOEA BATATAS (Linn.) Poir. in Lam. Encycl. 6 (1804) 14.

Convolvulus batatas Linn. Sp. Pl. (1753) 154.
Dioscorea cylindrica Burm. f. Fl. Ind. (1768) 215 (err. typ. 315).

Burman's species is typified by *Kappa-kelengu* Rheede Hort. Malabar. 7: *t. 50,* which clearly represents the common sweet potato. Hooker f., Fl. Brit. Ind. 6 (1892) 296, is in error in considering that Rheede's figure represents some cucurbitaceous plant. There is no evidence that Burman had any botanical material for examination in proposing the binomial *Dioscorea cylindrica.*

QUAMOCLIT Moench

QUAMOCLIT SAGITTAEFOLIA (Burm. f.) Choisy in DC. Prodr. 9 (1845) 335.

Ipomoea sagittaefolia Burm. f. Fl. Ind. (1768) 50, *t. 18, f. 2.* "Habitat in Java."
Ipomoea hastata Linn. Mant. 2 (1771) 204.
Ipomoea phaenicea Roxb. Fl. Ind. 2 (1824) 92.
Quamoclit phaenicea Choisy Conv. Or. (1834) 51.

This is clearly a yellow-flowered form of *Quamoclit phaenicea* (Spreng.) Choisy, which is, however, not clearly distinguishable from *Quamoclit coccinea* (Linn.) Moench.

ARGYREIA Loureiro

ARGYREIA MOLLIS (Burm. f.) Choisy Conv. Or. (1834) 38.

Convolvulus mollis Burm. f. Fl. Ind. (1768) 44, *t. 17.* "Habitat in Java."
Convolvulus sericeus Linn. Mant. 1 (1767) 43, non *Argyreia sericea* Dalz. & Gibs.

Burman's specific name is the proper one for this well-known Malayan species. It is suspected that both Burman's and Linnaeus's descriptions were based on material of similar origin.

ARGYREIA NERVOSA (Burm. f.) Bojer Hort. Maurit. (1837) 224.

Convolvulus nervosus Burm. f. Fl. Ind. (1768) 48, *t. 20, f. 1.* "Habitat Coromandeli."
Convolvulus speciosus Linn. f. Suppl. (1781) 137.
Argyreia speciosa Sweet Hort. Brit. (1827) 289.

Burman's specific name should be retained for this well-known species, which commonly appears in botanical literature as *Argyreia speciosa* Sweet.

HYDROPHYLLACEAE

HYDROLEA Vahl

HYDROLEA ZEYLANICA (Linn.) Vahl Symb. 2 (1791) 46.

Nama zeylanica Linn. Sp. Pl. (1753) 226.
Steris aquatica Burm. f. Fl. Ind. (1768) 73, *t. 39 f. 3.* "Habitat Coromandeli in locis aquosis."

This is clearly identical with *Hydrolea zeylanica* (Linn.) Vahl, a common and widely distributed species in the Indo-Malayan region. The figure is poor, but the description is ample.

BORAGINACEAE

TRICHODESMA R. Brown

TRICHODESMA ZEYLANICUM (Burm. f.) R. Br. Prodr. (1810) 496.

Borago zeylanica Burm. f. Fl. Ind. (1768) 41, *t. 14, f. 2.* "Habitat in Zeylona."

A common and well-known Indo-Malayan species. It was described by Linnaeus three years later under the same binomial, Mant. 2 (1771) 202.

VERBENACEAE

LIPPIA Houstoun

* **LIPPIA JAVANICA** (Burm. f.) Spreng. Syst. 2 (1825) 752.

Verbena javanica Burm. f. Fl. Ind. (1768) 12, *t. 6, f. 2.* "Habitat in Java."
Zapania javanica Lam. Ill. 1 (1791) 59.

This species is one of doubtful status. The figure is distinctly different from the common *Lippia nodiflora* (Linn.) Rich., which is figured on the same plate by Burman as *Verbena nodiflora* Linn. The only other species of the genus reported from Java is *Lippia asperifolia* Rich. to which Burman's description scarcely applies, although H. J. Lam in his recent treatment of the Verbenaceae of the Malay Archipelago states: "Probably this is the same as *L. asperifolia.*" Should this prove to be the case, Burman's specific name will replace Richard's.

PREMNA Linnaeus

PREMNA INTEGRIFOLIA Linn. Mant. 2 (1771) 252.

Premna serratifolia Linn. op. cit. 253.
Cornutia corymbosa Burm. f. Fl. Ind. (1768) 132, *t. 41, f. 1,* non *Premma corymbosa* Rottl. & Willd. "Habitat in Zeylona."

The two forms characterized by Linnaeus do not appear to be distinct. *Premna integrifolia* Linn. is primarily based on

Cornutia corymbosa Burm. f. *Premna corymbosa* Rottl. & Willd. was based on Indian material with no reference to Burman's *Cornutia corymbosa.* H. J. Lam, in his recent treatment of the Verbenaceae of the Malay Archipelago, interprets the Linnean species as a polymorphous one, reducing to it, among many others, *Premna foetida* Reinw., as well as the common coastal form with entirely glabrous leaves. The range is given as from Madagascar to tropical Asia, Malaysia, and Polynesia.

GMELINA Linnaeus

GMELINA ASIATICA Linn. Sp. Pl. (1753) 626.

Gmelina coromandelica Burm. f. Fl. Ind. (1768) 132. "Habitat in India utraque."

The Coromandel form is doubtless identical with the Linnean species, but the reference to Sloane probably represents an entirely different plant; I have not seen Sloane's figure.

CLERODENDRON Linnaeus

CLERODENDRON CALAMATOSUM Linn. Mant. 1 (1767) 90.

Volkameria alternifolia Burm. f. Fl. Ind. (1768) 137, *t. 44.*

Both species were described from Javan material, Burman's clearly being synonymous with the one described by Linnaeus one year earlier. *Volkameria alternifolia* Burm. f. was reduced to *Clerodendron calamatosum* by Linnaeus, Mant. 2 (1771). Both descriptions were probably based on material of similar origin.

CLERODENDRON PHLOMOIDES Linn. f. Suppl. (1781) 292.

Volkameria multiflora Burm. f. Fl. Ind. (1768) 137, *t. 45, f. 1,* non *Clerodendron multiflorum* G. Don. "Habitat in Java."

Burman's species seems to be identical with that later described by the younger Linnaeus, but his specific name is invalid in *Clerodendron.*

SOLANACEAE

SOLANUM Linnaeus

SOLANUM SURATTENSE Burm. f. Fl. Ind. (1768) 57.

Solanum xanthocarpum Schrad. & Wendl. Sert. Hanov. 1: 8, *t. 2;* C. B. Clarke in Hook. f. Fl. Brit. Ind. 4 (1883) 236, cum syn.

The specimens on which Burman's description was based were from Surat, India, collected by Garcin. The species is unaccounted for in Clarke's treatment of the Solanaceae of British India, but the description clearly applies to *Solanum xanthocarpum* Schrad. & Wendl., which Burman's binomial displaces.

The pre-Linnean references to Dillenius, Plukenet, and Ray probably do not belong here; and from one of those Dunal, who placed Burman's species as a synonym of *Solanum virginianum* Linn., doubtless interpreted Burman's species.

LABIATAE

BALLOTA Linnaeus

BALLOTA PERSICA (Burm. f.) Benth. Lab. Gen. Sp. (1836) 598, DC. Prodr. 12 (1848) 520.

Molucella persica Burm. f. Fl. Ind. (1768) 128, *t. 38, f. 2.*

Bentham's amplified description is based on Burman's specimen in the Delessert herbarium.

ANISOMELES R. Brown

ANISOMELES INDICA (Linn.) O. Kuntze Rev. Gen. Pl. (1891) 512.

Nepeta indica Linn. Sp. Pl. (1753) 571.
Anisomeles ovata R. Br. in Ait. Hort. Kew. ed. 2, 2 (1811) 364.
Ballota disticha Linn. Mant. 1 (1767) 83.
Ballota disticha Burm. f. Fl. Ind. (1768) 126.
Marrubium indicum Burm. f. op. cit. 127.

Ballota disticha Burm. f. was from Java and Coromandel and was described one year earlier by Linnaeus under the same binomial; both descriptions were doubtless based on material of similar origin. *Marrubium indicum* Burm. f. was from Ceylon and Java; and from the excellent figure cited, Burm. Thes Zeyl. (1737) 153, *t. 71, f. 1,* it is, like *Ballota disticha,* clearly identical with the very common and widely distributed *Anisomelis indica* (Linn.) O. Kuntze.

POGOSTEMON Desfontaines

POGOSTEMON BENGHALENSE (Burm. f.) O. Kuntze Rev. Gen. Pl. (1891) 529.

Origanum benghalense Burm. f. Fl. Ind. (1768) 128, *t. 38, f. 3.* "Habitat in Benghalia."
Pogostemon plectranthoides Desf. in Ann. Mus. Paris 2 (1803) 155.

Bentham, in DC. Prodr. 12 (1848) 151, cites Burman's species with certainty as a synonym of Desfontaines's *Pogostemon plectranthoides,* adding that the figure is very poor. Burman's specific name should be retained.

DYSOPHYLLA Blume

DYSOPHYLLA AURICULARIA (Linn.) Blume Bijdr. (1826) 826.

Mentha auricularia Linn. Mant. 1 (1767) 81.
Mentha foetida Burm. f. Fl. Ind. (1768) 126. "Habitat in Java."

The form Burman described was characterized one year earlier by Linnaeus as *Mentha auricularia. Majana foetida* Rumph. Herb. Amb. 6: 41, *t. 16, f. 2,* is correctly placed as a synonym by both Linnaeus and Burman. Burman's species was reduced to *Mentha foetida* by Linnaeus Mant. 2 (1771).

ACROCEPHALUS Bentham

ACROCEPHALUS INDICUS (Burm. f.) O. Kuntze Rev. Gen. Pl. (1891) 511.
Prunella indica Burm. f. Fl. Ind. (1768) 130.
Ocimum capitatum Linn. f. Suppl. (1781) 276.
Acrocephalus capitatus Benth. in Wall. Pl. As. Rar. 2 (1831) 18.

Burman's species was based on a Javan specimen, "*Brunella javanica* D. Kleinhof." It is commonly known as *Acrocephalus capitatus* Benth., but Burman's specific name should be retained.

GENIOSPORUM Wallich

GENIOSPORUM TENUIFLORUM (Linn.) comb. nov.
Ocimum tenuiflorum Linn. Sp. Pl. (1753) 597.
Geniosporum prostratum Benth. in Bot. Reg. sub. *t. 1300,* et in Wall. Pl. As. Rar. 2 (1831) 18.
Thymus indicus Burm. f. Fl. Ind. (1768) 129. "Habitat Coromandeli."

This species is currently known as *Geniosporum prostratum* Benth., but it would seem that the Linnean specific name should be adopted for it.

OCIMUM Linnaeus

OCIMUM SANCTUM Linn. Mant. 1 (1767) 85.
Ocymum inodorum Burm. f. Fl. Ind. (1768) 130. "Habitat in India."

Burman's species is apparently a synonym of *Ocimum sanctum* Linn., where it is definitely placed by Bentham. The figure in Burman Thesaurus Zeylanicus (1737) 175, *t. 80, f. 2,* is good for the Linnean species, and from this citation the younger Burman took his specific name; the Javan *Sulassi puti-utan,* judging from this native name, might be *Ocimum basilicum* Linn.

LABIATAE OF DOUBTFUL STATUS

* **SCUTELLARIA ? JAPONICA** Burm. f. Fl. Ind. (1768) 130. "Habitat in Japonia, Java."

Two species are involved, but the form actually described by Burman was the Javan plant. It has been reduced by Bentham in part to *Plectranthus coetsa* D. Don, which is not known from either Java or Japan; and in part to *Melissa parviflora* Benth., likewise definitely known from neither Japan nor Java, although Bentham actually examined the species in Burman's herbarium. A critical examination of the type material is desirable.

SCROPHULARIACEAE

SCHWEINFURTHIA A. Braun

SCHWEINFURTHIA PAPILIONACEA (Linn.) Boiss. Fl. Orient. 4: 387.

Antirrhinum papilionaceum Linn. Mant. 1 (1767) 86.
Antirrhinum papilionaceum Burm. f. Fl. Ind. (1768) 131, *t. 39, f. 2.* "Habitat in Persia."
Schweinfurthia sphaerocarpa A. Braun in Sitzb. Ges. Naturf. Fr. 20 (1866) 24.

Both Burman's and Linnaeus's binomials were probably based on material from the same collection, the latter's publication having priority by one year.

ARTANEMA D. Don

ARTANEMA LONGIFOLIA (Linn.) comb. nov.

Columnea longifolia Linn. Mant. 1 (1767) 90.
Sesamum javanicum Burm. f. Fl. Ind. (1768) 133. "Habitat in India."
Archimenes sesamoides Vahl Symb. 2 (1791) 71.
Artanema sesamoides Benth. Scroph. Ind. (1835) 39.
Artanema longiflora Wettst. in Engl. & Prantl Nat. Pflanzenfam. 4^{3b} (1891) 79.

The Linnean name is one year earlier than Burman's, and both are much earlier than that proposed by Vahl on which Bentham's binomial is based. It is suspected that both *Columnea longifolia* and *Sesamum javanicum* were based on material of similar origin.

LINDERNIA Allioni

(*Vandellia* Linnaeus)

LINDERNIA CRUSTACEA (Linn.) F. Muell. Census (1882) 97.

Capraria crustacea Linn. Mant. 1 (1767) 87.
Capraria crustacea Burm. f. Fl. Ind. (1768) 133.
Capraria uniflora Burm. f. l. c. *t. 14* (err. typ. *19*), *f. 3.*
Vandellia crustacea Benth. Scroph. Ind. (1835) 35.

Capraria crustacea Burm. f. is identical with the species described one year earlier by Linnaeus under the same binomial; both descriptions were doubtless based on material of similar origin. For *Capraria uniflora* Burman cites no locality; but, judging from the figure, it is synonymous with *Capraria crustacea* Linn. = *Lindernia crustacea* (Linn.) F. Muell.

ILYSANTHES Rafinesque

(*Bonnaya* Reichenbach)

ILYSANTHES ANTIPODA (Linn.) Merr. Interpret. Herb. Amb. (1917) 467.
Ruellia antipoda Linn. Sp. Pl. (1753) 635.
Ruellia anagallis Burm. f. Fl. Ind. (1768) 135. "Habitat in Java and Amboina."
Gratiola veronicaefolia Retz. Obs. 4 (1786) 8.
Bonnaya veronicaefolia Spreng. Syst. 1 (1825) 41.

Burman's species is clearly identical with the very common and widely distributed form currently known as *Bonnaya veronicaefolia* Spreng. *Crusta ollae major* Rumph. Herb. Amb. **5**: 460, *t. 170, f. 2,* cited by Burman as representing his species, is correctly placed as a synonym.

BIGNONIACEAE

CRESCENTIA Linnaeus

* **CRESCENTIA OVATA** Burm. f. Fl. Ind. (1768) 132. "Habitat in Java."
Crescentia cucurbitina Linn. Mant. 2 (1771) 250.

If the current reduction of Burman's species be correct it will involve the acceptance of his specific name. However, the only species of the genus reported from Java is *Crescentia cujete* Linn., and Burman's description is so short and imperfect that it is impossible to determine from it alone to which of the Linnean species it applies. All the species of the genus are natives of tropical America.

ACANTHACEAE

DYSCHORISTE Nees

DYSCHORISTE MADURENSIS (Burm. f.) O. Kuntze Rev. Gen. Pl. (1891) 486.
Justicia madurensis Burm. f. Fl. Ind. (1768) 9, *t. 4, f. 3.* "Habitat in Madura."
Ruellia littoralis Linn. f. Suppl. (1781) 289.
Calophanes littoralis T. Anders. in Thw. Enum. Pl. Zeyl. (1859–64) 225.

This is the basis of *Dyschoriste madurensis* (Burm. f.) O. Kuntze, of which *Calophanes littoralis* T. Anders. (*Ruellia littoralis* Linn. f.) is a synonym.

DYSCHORISTE ERECTA (Burm. f.) O. Kuntze Rev. Gen. Pl. (1891) 485.
Ruellia erecta Burm. f. Fl. Ind. (1768) 135, *t. 41, f. 3.* "Habitat in India."
Calophanes nagchana Nees in DC. Prodr. 11 (1847) 109.

This is the basis of *Dyschoriste erecta* (Burm. f.) O. Kuntze, of which *Calophanes nagchana* Nees is apparently a synonym.

HEMIGRAPHIS Nees

HEMIGRAPHIS ALTERNATA (Burm. f.) T. Anders. in Journ. Linn. Soc. Bot. 7 (1864) 114.

Ruellia alternata Burm. f. Fl. Ind. (1768) 135. "Habitat in Java."
Ruellia blumeana Nees in DC. Prodr. 11 (1847) 149.
Ruellia repanda Blume Bijdr. (1825) 794, non Linn.
Hemigraphis blumeana Boerl. Handl. Fl. Nederl. Ind. 2 ^{2} (1899) 658.

The reference to *Prunella silvestris alba* Rumph. Herb. Amb. 6: 31, *t. 13, f. 2,* should be excluded, as it represents *Hemigraphis reptans* K. Schum. var. *glaucescens* Hallier f. The reference to Rheede Hort. Malabar. 9: 115, *t. 59,* should also be excluded.

RUELLIA Plumier

RUELLIA REPENS Linn. Mant. 1 (1767) 89.

Ruellia repens Burm. f. Fl. Ind. (1768) 135, *t. 41, f. 2* (err. typ. *f. 1*). "Habitat in Java."

I consider that Burman's figure represents *Ruellia repens* as described one year earlier by Linnaeus, although C. B. Clarke, Journ. As. Soc. Beng. 74 ^{2} (1907) 649, considered that it represents a plant not of the genus *Ruellia.* The probability is very great that both descriptions were based on material of similar origin.

BLEPHARIS Jussieu

BLEPHARIS PERSICA (Burm. f.) O. Kuntze Rev. Gen. Pl. (1891) 483.

Ruellia persica Burm. f. Fl. Ind. (1768) 135. "Habitat in Persia."
Acanthus edulis Forsk. Fl. Aeg.-Arab. (1775) 115.
Blepharis edulis Pers. Syn. 2 (1807) 180.

Burman's specific name, being much older than Forskål's, should be retained for this species.

BLEPHARIS MADERASPATENSIS (Linn.) Heyne ex Roth Nov. Pl. Sp. (1821) 320.

Acanthus maderaspatensis Linn. Sp. Pl. (1753) 639.
Acanthus ciliaris Burm. f. Fl. Ind. (1768) 139, *t. 42, f. 3.* "Habitat in Zeylona."
Blepharis boerhaaviaefolia Pers. Syn. 2 (1807) 180.

Burman's species is clearly identical with the Linnean one.

ANDROGRAPHIS Wallich

ANDROGRAPHIS PANICULATA (Burm. f.) Nees in Wall. Pl. As. Rar. 3 (1832) 116.

Justicia paniculata Burm. f. Fl. Ind. (1768) 9. "Habitat in Malabaria & Zeylonia."

This is the basis of the well-known *Andrographis paniculata* (Burm. f.) Nees.

PERISTROPHE Nees

PERISTROPHE HYSSOPIFOLIA (Burm. f.) comb. nov.

> *Dianthera hyssopifolia* Burm. f. Fl. Ind. (1768) 11, *t. 5, f. 2.* "Habitat in Java."
> *Justicia salicifolia* Blume ex Steud. Nomencl. ed. 2 1 (1841) 839.
> *Peristrophe salicifolia* Hassk. Cat. Hort. Bogor. (1844) 152.

The description and excellent figure clearly indicate that Burman's species is the same as the one later described by Blume. *Peristrophe acuminata* Nees, *P. blumeana* Nees, and *Justicia roxburghiana* Blume are probably synonyms of the same species.

CLINACANTHUS Nees

CLINACANTHUS NUTANS (Burm. f.) Lindau in Engl. Bot. Jahrb. 18 (1894) 63.

> *Justicia nutans* Burm. f. Fl. Ind. (1768) 10, *t. 5, f. 1.* "Habitat in Java."
> *Clinacanthus burmanni* Nees in DC. Prodr. 11 (1847) 511.
> *Justicia fulgida* Blume Bijdr. (1825) 784.

A well-known species extending from Siam to Hainan, the Malay Peninsula, Borneo, and Java.

JUSTICIA Houstoun

JUSTICIA GENDARUSSA Burm. f. Fl. Ind. (1768) 10; Linn. f. Suppl. (1781) 85. "Crescit in Malabara, Amboina & Java."

A common and well-known species of wide distribution in the Indo-Malayan region.

* **JUSTICIA MORETIANA** Burm. f. Fl. Ind. (1768) 10. "Crescit in variis locis Indiae arenosis."

This is typified by *Adhatoda flore solitario*, etc., Burm. Thes. Zeyl. (1737) *t. 3, f. 1*, and is clearly a *Justicia*. Trimen, Fl. Ceyl. 3 (1895) 335, states that the figure, although good, does not agree with any known Ceylon species. The synonym "*Moretiana* Rumph. 6, p. 53, t. 23," must be excluded, as it represents *Ruellia repens* Linn.

RUBIACEAE

OLDENLANDIA Linnaeus

OLDENLANDIA CORYMBOSA Linn. Sp. Pl. (1753) 119.

> *Oldenlandia tenuifolia* Burm. f. Fl. Ind. (1768) 37, *t. 14, f. 1.* "Habitat in Java."

This appears to be a form of *Oldenlandia corymbosa* Linn., with the inflorescences reduced to a single long-pedicelled flower, or it is possibly a reduced form of *Oldenlandia herbacea* (Linn.) Roxb. (*O. heynii* G. Don).

DENTELLA Forster

DENTELLA REPENS (Linn.) Forst. Char. Gen. (1776) 26, *t. 13.*

Oldenlandia repens Mant. 1 (1767) 40.

Oldenlandia repens Burm. f. Fl. Ind. (1768) 38, *t. 15, f. 2.* "Amat loca paludosa Coromandeli."

It is not certain that Burman's species is identical with the Linnean one, although there is nothing in the description or in the rather indefinite figure contrary to this interpretation of it.

BORRERIA G. F. Meyen

BORRERIA OCYMOIDES (Burm. f.) DC. Prodr. 4 (1830) 544.

Spermacoce ocymoides Burm. f. Fl. Ind. (1768) 34, *t. 13, f. 1.* "Sajor Babi Javanis." [That is, the type from Java, with the Javanese name *sajor babi.*]

The range of this species outside of Java is more or less confused by species of other authors that have apparently been erroneously reduced to it. It is, however, apparently of wide distribution in the Malayan region.

PAEDERIA Linnaeus

PAEDERIA FOETIDA Linn. Mant. 1 (1767) 52.

Apocynum foetidum Burm. f. Fl. Ind. (1768) 71. "Habitat in India."

While *Paederia tomentosa* Blume is generally recognized as a distinct species, there seem to be no constant characters by which it can be distinguished from the Linnean one.

CUCURBITACEAE

BLASTANIA Kotschy and Peyr.

BLASTANIA GARCINI (Burm. f.) Cogn. in DC. Monog. Phan. 3 (1881) 629.

Sicyos garcini Burm. f. Fl. Ind. (1768) 211 (err. typ. 311). "Habitat in Zeylona."

Sicyos garcini Linn. Mant. 2 (1771) 297.

Ctenolopis garcini C. B. Clarke in Hook. f. Fl. Brit. Ind. 2 (1879) 629.

A well-known species of southern India and Ceylon.

CAMPANULACEAE

LOBELIA Plumier

* **LOBELIA PUMILA** Burm. f. Fl. Ind. (1768) 186, *t. 60, f. 3.*

I suspect that this is a true *Lobelia* in spite of the leaves being described and figured as opposite; it is perhaps near *Lobelia zeylanica* Linn. The type was from Coromandel.

COMPOSITAE

VERNONIA Schreber

VERNONIA CINEREA (Linn.) Less. in Linnaea 4 (1829) 291.

Conyza cinerea Linn. Sp. Pl. (1753) 862.

Conyza ivaefolia Burm. f. Fl. Ind. (1768) 180, *t. 58, f. 4.* "Habitat in Java."

While the figure is not particularly good for *Vernonia cinerea* Less., I cannot suggest any other reduction of Burman's species. The description consists merely of the statement: "foliis alternis lanceolatis repando-dentatis."

EUPATORIUM Tournefort

*** EUPATORIUM** sp.

Erigeron pisonis Burm. f. Fl. Ind. (1768) 180, *t. 59, f. 2.* "Brasilia."

This was based on a Brazilian specimen collected by Piso, and is apparently a *Eupatorium.* Dr. B. L. Robinson, of the Gray Herbarium, who has an extensive knowledge of the tropical American Compositae, informs me that he does not recognize the species, but that the habit, foliage, and to some extent the inflorescence recall *Eupatorium ballotaefolium* HBK. and *Conyza anomala* DC., although Burman's positive statement "Caul. * * * glaberrimus" does not fit either of these species, since both always have a perceptible pubescence on the stems.

MIKANIA Willdenow

MIKANIA SCANDENS (Linn.) Willd. Sp. Pl. 3 (1804) 1743.

Eupatorium scandens Linn. Sp. Pl. (1753) 836.

Eupatorium cordatum Burm. f. Fl. Ind. (1768) 176, *t. 58, f. 2.* "Habitat in Java & Vera Cruce."

Burman's species is clearly referable to the common pantropic *Mikania scandens* (Linn.) Willd.

BLUMEA de Candolle

BLUMEA LACERA (Burm. f.) DC. Prodr. 5 (1836) 436.

Conyza lacera Burm. f. Fl. Ind. (1768) 180, *t. 59, f. 1.*

This was based on a Javan specimen and is supposedly the basis of *Blumea lacera* (Burm. f.) DC., Burman's species being indicated by de Candolle as var. *burmanni* DC.

EPALTES Cassini

EPALTES DIVARICATA (Linn.) Cass. in Bull. Soc. Philom. (1818) 139.

Ethulia divaricata Linn. Mant. 1 (1767) 110.

Ethulia divaricata Burm. f. Fl. Ind. (1768) 176. "Coromandeli."

Both descriptions were doubtless based on material of similar origin.

SPHAERANTHUS Vaillant

SPHAERANTHUS AMARANTHOIDES Burm. f. Fl. Ind. (1768) 186.

The type was a specimen from Coromandel. The species is a well-known one of India and Ceylon.

ANVILLEA de Candolle

ANVILLEA GARCINI (Burm. f.) DC. Prodr. 5 (1836) 487.

Anthemis garcini Burm. f. Fl. Ind. (1768) 183, *t. 60, f. 1* (as *Buthalmum garcini* Burm. f.).

This is the basis of *Anvillea garcini* (Burm. f.) DC. and is the type of the genus. It was based on a specimen from Persia, collected by Garcin.

GYNURA Cassini

GYNURA BIFLORA (Burm. f.) comb. nov.

Senecio biflorus Burm. f. Fl. Ind. (1768) 181. "Habitat in Java."

From the Javanese name cited, *blontas China*, it is suspected that this was a cultivated plant in Java, of Chinese origin. The description is definite and applies unmistakably to the species currently known as *Gynura pseudo-china* DC.

SENECIO Tournefort

SENECIO TENUIFOLIUS Burm. f. Fl. Ind. (1768) 181, *t. 60, f. 4*. "Habitat in Java."

This is a sufficiently well-known species of India and Java, of which *Senecio multifidus* Willd. is a synonym.

* **SENECIO CORONOPIFOLIUS** Burm. f. Fl. Ind. (1768) 181, *t. 60, f. 5*. "Habitat in Java."

Senecio javanicus Willd. Sp. Pl. 3 (1800) 1984.

Senecio javanicus Willd. is merely a new name for Burman's species. It is a species of doubtful status and is probably no *Senecio*.

LIGULARIA Cassini

LIGULARIA TUSSILAGINEA (Burm. f.) Makino in Bot. Mag. Tokyo 18 (1904) 52.

Arnica tussilaginea Burm. f. Fl. Ind. (1768) 182.

Tussilago japonica Linn. Mant. 1 (1767) 113, non *Ligularia japonica* (Thunb.) Less.

Senecio kaempferi DC. Prodr. 6 (1837) 363.

Ligularia kaempferi Sieb. & Zucc. Fl. Jap. 1 (1835) 77, *t. 35*.

Senecio tussilaginea O. Kuntze Rev. Gen. Pl. (1891) 364.

Farfugium kaempferi Benth. Fl. Hongk. (1861) 191.

Burman's species was based on Japanese material, possibly on the same collection that yielded the type of *Tussilago japonica* Linn. The latter typifies *Senecio kaempferi* DC. Burman's specific name should be retained for the species.

EMILIA Cassini

EMILIA JAVANICA (Burm. f.) C. B. Rob. in Philip. Journ. Sci. 3 (1908) Bot. 217.

Hieracium javanicum Burm. f. Fl. Ind. (1768) 174, *t. 57, f. 1.* "Java."
Prenanthes javanica Willd. Sp. Pl. 3 (1800) 1534.
Sonchus javanicus Spreng. Syst. 3 (1826) 648.
Emilia flammea Cass. in Dict. Sci. Nat. 14 (1819) 406, *t. 5.*

Burman's specific name should be retained for this species, which is allied to, but distinct from, *Emilia sonchifolia* DC.

SONCHUS Linnaeus

* **SONCHUS** sp.

? Senecio auriculatus Burm. f. Fl. Ind. (1768) 181. "Habitat in Java."

This is perhaps a species of *Sonchus*, possibly *S. oleraceus* Linn. or *S. arvensis* Linn.; but the description is too short to warrant a more definite reduction from it alone.

COMPOSITAE OF DOUBTFUL STATUS

* **LAPSANA JAPONICA** Burm. f. Fl. Ind. (1768) 174. "Habitat in Japonia."

This is clearly no representative of the genus *Lapsana*. The type was from Japan, and Dr. B. Hayata informs me that neither he nor any of the other Japanese botanists at Tokyo recognizes the species from the description.

* **ERIGERON DENTICULATUM** Burm. f. Fl. Ind. (1768) 180.

The type of this genus was a Javan specimen. From the very short description it is suspected that it is a synonym of *Pluchea indica* (Linn.) Less., but the correctness of this suggested reduction can scarcely be determined from the description alone.

* **ERIGERON INDICUM** Burm. f. Fl. Ind. (1768) 180. "Habitat in Java."

This is probably not an *Erigeron*, but Burman's description is altogether too short to warrant a definite reduction of it from the description alone.

SPECIES OF WHOLLY DOUBTFUL STATUS

* **ACER PLATANUS** Burm. f. Fl. Ind. (1768) 221. "Habitat in India."

Pax, in Engl. Pflanzenreich 8 (1902) 76, states regarding this species "Vix Aceris species." There is nothing in the de-

THE PHILIPPINE BUREAU OF SCIENCE

RECENT PUBLICATIONS

AN INTERPRETATION OF RUMPHIUS'S HERBARIUM AMBOINENSE

By E. D. MERRILL

Based on the collections made in Amboina by the late Charles Budd Robinson

Order No. 450. Bureau of Science Publication No. 9. Paper, 595 pages and 2 maps.

Price, $3 United States currency, postpaid.

SPECIES BLANCOANAE: A CRITICAL REVISION OF THE PHILIPPINE SPECIES OF PLANTS DESCRIBED BY BLANCO AND BY LLANOS

By E. D. MERRILL

Order No. 461. Bureau of Science Publication No. 12. Paper, 423 pages and 1 map.

Price, $2.25 United States currency, postpaid.

PHILIPPINE WATER SUPPLIES

By George W. Heise and A. S. Behrman

Order No 460. Bureau of Science Publication No. 11. Paper, 218 pages, 19 plates, and 4 text figures.

Price, $1.75 United States currency, postpaid.

VEGETATION OF PHILIPPINE MOUNTAINS

The relation between the environment and physical types at different altitudes

By WILLIAM H. BROWN

Order No. 473. Bureau of Science Publication No. 13. Paper, 434 pages, 41 plates, 30 text figures.

Price, $2.50 United States currency, postpaid.

PLEASE GIVE ORDER NUMBER

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the following agents:

AGENTS

THE MACMILLAN COMPANY, 64-66 Fifth Avenue, New York, U. S. A.
WHELDON & WESLEY, Limited, 28 Essex Street, Strand, London, W. C., England.
MARTINUS NIJHOFF, Lange Voorhout 9, The Hague, Holland.
KELLY & WALSH, Limited, 32 Raffles Place, Singapore, Straits Settlements.
THACKER, SPINK & CO., P. O. Box 54, Calcutta, India.
THE MARUZEN CO., Limited, 11-16 Nihonbashi, Tori-Sanchome, Tokyo, Japan.

CONTENTS

Page.

MAXWELL, J. PRESTON. Filariasis in China............. 257

MERRILL, ELMER D. A review of the new species of plants proposed by N. L. Burman in his Flora indica.. 329

The Philippine Journal of Science is issued twelve times a year. The sections were discontinued with the completion of Volume XIII (1918).

Yearly subscription, beginning with Volume XIV, 5 dollars United States currency. Single numbers, 50 cents each.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed on the third page of this cover.

Entered at the post office at Manila, P. I., as second-class matter.